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THESIS

AN ANALYSIS OF C³I EFFECTIVENESS
USING THE RESA WARGAME

by

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June, 1994

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An Analysis of C^4I Effectiveness

Using The RESA Wargame

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ABSTRACT

This thesis describes qualitative and quantitative analyses of the tactical effects of differing levels of command, control, communications, computers, and intelligence (C^4I). The RESA wargame at the Naval Postgraduate School was utilized in an experiment with 24 United States Naval Officers. The thesis begins with an introduction of the importance of C^4I and then discusses several aspects of wargames. The experimental plan (with corresponding appendices) covers all aspects of the actual experiment, including scenario description, conduct of each simulation run, and data collection. Analyses are performed on the data utilizing graphs and statistical printouts. A mean value differential analysis is also performed for additional clarification of results. Offensive and defensive results are discussed with respect to the two factors of warfare specialty and information level. Both factors did affect offensive performance. Players from the TACAIR community were able to place a greater percentage of ordinance on target. Additionally, as information level increased, the total number, as well as percentage of strike aircraft reaching the target increased up to the final level, in which a slight decrease was observed. However, neither of the two factors had an effect on defensive performance. The thesis concludes with the authors' opinions as to any results which were contrary to those anticipated, as well as recommendations for follow-on study and lessons learned.

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I. INTRODUCTION

A. PURPOSE OF THESIS

The purpose of this thesis is to evaluate the effects of Command, Control, Communications, Computers and Intelligence (C⁴I) on Carrier Battle Group (CVBG) operations. During the last few years a great deal of emphasis has been placed on improving the military's C⁴I capability. The Global Command and Control System (GCCS), Copernicus and C⁴I for the Warrior are all initiatives designed to increase the military's ability to transfer, process and utilize the vast amounts of strategic and tactical data gathered during the planning and execution of military operations. As resources for the design and procurement of military forces decline, the importance of achieving the "most bang for the buck" becomes critical. An effective C⁴I system gives the commander the ability to tailor his forces and deliver the maximum striking power available while minimizing the threat to his own forces.

B. RESEARCH QUESTIONS

- What is the effective improvement or degradation, if any, to the striking capability of the battle group if C⁴I is improved?
- What is the effective improvement or degradation to the defensive capability of the battle group if C⁴I is improved?

- How effective is C⁴I as a Battle Group Force Multiplier in a Littoral Environment?

C. METHODOLOGY

The Research Evaluation System Analysis (RESA) wargame was utilized to conduct qualitative and quantitative analyses on the impact of Command, Control and Intelligence on the ability of a CVBG to conduct offensive air strike operations while maintaining an effective defensive posture. Players participated in a tactical decision-making process during a simulated potential conflict involving North Korea. Each scenario required the player to command both air and surface naval forces during an air-strike mission conducted on a North Korean nuclear power facility. Additionally, an appropriate defensive posture was required to protect the CVBG against North Korean retaliation. Communications and Computers were not addressed due to the inability to effectively incorporate changes in these parameters in the RESA wargame. Command and Control data were gathered from interviews with wargame participants concerning their actions during simulation play. These interviews provided the basis for the qualitative assessment as well as some of the quantitative information.

Intelligence information was provided to the participants prior to and during their simulation run. This information was utilized to formulate an offensive and defensive strategy, as well as provide updates about enemy forces and intentions

throughout the wargame. Variations in the resolution of intelligence information permitted observation of their effects on planning and execution of military operations. Data collected in this area primarily consisted of aircraft attritions and the amount of ordnance placed on target. The simulations provided a controlled environment as well as the quantitative data necessary for an in-depth analysis.

D. SCOPE

This thesis focuses on CVBG operations in a littoral environment. The primary emphasis is centered around strike planning and execution as well as maintaining an effective anti-air warfare (AAW) posture. In addition, anti-surface warfare (ASUW) played an important role; however, anti-submarine warfare (ASW) was not considered.

II. BACKGROUND AND HISTORY

A. RELEVANCE OF C'I TO WARFIGHTING

Command is a function that arranges and coordinates everything that an organization or military force needs to perform its assigned mission. (Van Creveld, 1985, p6) Command responsibilities are directly proportional to the force's complexity and sophistication. The three major elements of a command system are organizations, procedures and technical means. (Van Creveld, 1985, p10) Control is the means by which command functions are executed. It is the application, managing and administration of the command elements in a coordinated effort to accomplish a mission. Although it is possible to have command without control, the converse is not necessarily true. Effective management and leadership requires the integration of command and control. Command and control is thus a complex process of data collection, analysis and decision making skills utilized by an individual or group of people when a decision must be made and executed.

Communications consist of the method of data transfer between different groups. This can be something as simple as a verbal exchange or can be as complex as an intricate satellite communications network. Communications incorporate the flow of information necessary to accomplish a task.

Computers have greatly increased the amount of data that can be collected and processed. Additionally, computers play an important role in the transfer of data and thus have a significant impact on communication systems. In fact, the importance of computers is felt throughout the entire C⁴I spectrum.

Intelligence information has always played a key role in determining an adversary's intention. Intelligence is the total collection of information relevant to effective combat system employment during the on-going, evolving or ultimately planned operation or as otherwise used in the fulfillment of command/mission objective. (Alphatech, 1994, p1)

1. Historical Framework

The parameters affecting C⁴I are the same today as they were centuries ago. Commanders have always sought to gain as much intelligence about their adversary's intention as possible. Spies and diplomats have always been a valuable source of information and have been utilized successfully throughout history. Prior to 1800 the additional sources of intelligence available included books and maps from which a commander could sift information concerning the intended theater of operations, terrain features, climate, enemy composition and disposition. (Van Creveld, 1985, p19)

Communication functions had a major influence on the commander's ability to control his force(s). Perhaps the most

important factor was the amount of time required to pass information from sender to receiver through a human courier. The time required was a function of distance and thus the greater the distance the less up-to-date the information was. The telegraph was the first substantial advance in communications; however, dependent upon wires and fixed transmitting/relaying stations, their usefulness was more suited to defensive roles and strategic, administrative and logistic communications. (Van Creveld, 1985, p107) However, due to the telegraph's vulnerability and unreliability, tactical communication was transmitted via couriers in the traditional way. (Van Creveld, 1985, p10)

Computing systems were comprised of human tabulators responsible for compiling, analyzing and reporting on the information obtained. Napoleon created the Statistical Bureau which obtained long-range strategic enemy intelligence, analyzed the data and reported the results to military planner (Van Creveld, 1985, p66) Although these "human computers" performed a vital function, they were limited in the amount of data they could analyze and were prone to errors.

Command and control functions were greatly influenced by the sophistication of intelligence, communications and "computing capabilities." The ability to effectively control a military force restricted its size and disposition. Logistics rather than strategy often forced commanders to divide their forces into smaller, more manageable units.

Terrain and supporting infrastructures often placed limits on the amount of men and equipment that a given area could support (Van Creveld, 1985, p25) As late as the eighteenth century no European army had a permanent formation larger than 2,250 men. (Van Creveld, 1985, p24)

The ancient Romans recognized this "command and control" predicament and devised the legion as a means to solve the problem. The legion was an administrative unit, not a tactical one; subordinate units carried out tactical movements because they were better able to control the forces under their command. (Van creveld, 1985, p46) Centuries later, this concept was applied by Napoleon as he divided his army into smaller, more manageable, and thus more effective, divisions and corps. (Van Creveld, 1985, p72)

2. **Present**

Modern day intelligence collection methods incorporate a wide variety of techniques. Although diplomats and spies still provide valuable information, complex electronic devices have made it possible to exploit the electromagnetic spectrum to gather imagery, communication and signal data about an adversary.

Communication methods have also evolved dramatically. Once dependent upon the courier for reliable information transfer, new methods such as radio frequency (RF), microwave, fiber optics and satellite communications have made it

possible to send vast amounts of information in a fraction of the time. Commanders at all levels can communicate with other members virtually at will.

Computer technology has advanced so rapidly that it is possible to process and analyze such a large amount of data that information overload becomes a serious concern. Errors are almost non-existent and there is virtually no limit to the amount of information that can be processed.

The command and control issues facing the commander today are much more complex than they were historically. There are now more types of intelligence gathering devices and more communication methods available that the commander must effectively manage and utilize. Each new generation of equipment and technology tends to be more complex than the one it replaced, and consequently the logistic, administrative and operating requirements become more complicated. (Van Creveld, 1985, p234) Specialization has become more common and is an accepted way to ensure that new technologies are adequately managed. Centralization of command and control functions is also sometimes applied in an attempt to ensure effective control of military forces.

3. Future

Future command and control systems will undoubtably be even more sophisticated as they will surely have to be able to manage an ever increasing array of intelligence gathering

devices, communication networks and computer systems. Data fusion techniques are currently being developed to provide the commander with the ability to access intelligence data bases through various types of communication systems. The C⁴I for the Warrior initiative is designed to provide a fused real time, true representation of the warrior's battlespace. (C⁴I FTW, 1993, p4) The Copernicus system is designed to provide the user with the ability to input data (push) into the system and retrieve (pull) information from the system relevant to his situation. This architecture utilizes a large data base of information that is available to a multitude of users. The information available for (pulling) is subject to security procedures, thus controlling information within established security requirements.

Artificial intelligence development, multilevel security systems and data compression and transmission techniques all will have an impact on future C⁴I systems. The successful integration of intelligence collection, communication devices and computing systems into an architecture that will allow a commander to effectively command and control his force will certainly be a challenge.

B. DETERMINING C⁴I REQUIREMENTS

Determining C⁴I requirements is accomplished by assessing the current and desired warfighting capabilities of the military force. Deficiencies are noted and various

alternative solutions are identified for consideration. A qualitative and quantitative appraisal is performed on alternative solutions so that the best solution may be identified to correct the deficiency.

1. Warfighting Assessment

Assessing the warfighting capabilities and requisites of a military force requires a thorough examination of the intended areas of operation. The area(s) of intended operation greatly influence C⁴I system development and implementation. Once identified, C⁴I system requirements can be recognized and procured within existing constraints.

a. *Scenarios of Intended Operations*

The geographic location in which a military organization is intended to operate and the mission it is assigned to perform has a significant effect on how the force is composed and supported. For example, a CVBG conducting strike operations against land targets while maintaining an effective defense against retaliatory air strikes has different concerns than an ASW task force assigned to patrol and track all unknown submarine contacts. The C⁴I system that supports the organization must enable the task force to perform its mission to the utmost of its ability so that it can maximize its offensive and defensive potential.

Historically, naval forces were required to ensure that the "Sea Lanes of Communication" were free of obstruction

so that United States and allied forces could "project their power" anywhere in the world. Typically, this strategy was centered around the desire to contain Soviet and communist expansion on a global scale. With the collapse of the Soviet Union and the fall of communist regimes in eastern Europe, U.S. national strategy has shifted from a focus on a global threat to a focus on regional challenges. (From the Sea, 1992, p1) Although the focus has been redefined, American forces will still be called upon to accomplish traditional missions of strategic deterrence, control of the seas, extended and continuous on-scene crisis response, power projection and large scale sealift. (From the Sea, 1992, p1)

Littoral environment campaigns appear to encompass the majority of future military operations. Whether the mission is support for a humanitarian relief effort off the coast of Somalia, counter-narcotic operations in the Caribbean Sea or extensive strike operations conducted in support of a "Desert Storm" style conflict, U.S. naval forces will be operating in a littoral environment. Consequently, C'I systems must be optimized for these types of operations.

b. Constraints

Unfortunately there are many constraints that hinder the development, procurement and installation of effective C'I systems. Some of these constraints include

technology, funding, force levels and composition, time and national military strategies.

Technological constraints include the limitations of current systems. Communication networks and computer systems are limited by weight and the capacity of information they can handle. Intelligence gathering methods are limited by the resolution of sensors and amount of information that can effectively be collected.

Fiscal constraints perhaps have the most significant effect on C⁴I systems. Although a system may meet the need of a military force, the cost of the system may preclude its procurement. Another factor is that military effectiveness is often measured in easily quantifiable terms. Attrition rates, amount of ordnance placed on target and delivery rates all provide excellent ways to compare systems; however, C⁴I systems are not easily quantifiable and thus can suffer from funding cuts unless they can clearly demonstrate their usefulness.

The large variety of military forces and their composition affect the design and usage of C⁴I systems. A system must be interoperable. Every unit within the entire force must be integrated into the system and be able to effectively utilize the system. The diversity, complexity and specialization of military units create additional problems for successful implementation of C⁴I systems.

Time imposes additional constraints because in many situations C⁴I systems must be deployed as soon as possible, and adequate development lead time may not be available. This sometimes leads to a "quick fix" solution, and subsequently a more capable system is never developed.

As national military strategies are redefined in response to the changing global environment, C⁴I systems must adapt to accommodate the changing demands. This constraint often requires systems to be specialized enough to comply with current strategy demands, yet general enough to adjust to evolving strategies.

2. Qualitative Appraisal

Qualitative appraisals permit the evaluator to assess a system and determine the benefits and limitations in a subjective manner. Although this type of survey does not generally incorporate an objective analysis, it provides a method to evaluate a system.

a. Benefits

Analyses of this nature have the benefit of not being dependent upon a statistical analysis. The evaluation often considers numerous intangible features that may not be quantifiable. In many instances where human interaction is involved, this type of appraisal is required to some degree. It is very difficult, if not impossible, to quantify all important human decision-making characteristics.

b. Limitations

The limitations of the qualitative evaluation include excessive reliance on human judgment in the absence of sound statistical observations. A quantitative, statistical analysis precisely measures the correlations and differences between important variables, highlights observed trends and provides a solid anchor for decisions to be made.

3. **Quantitative Appraisal**

Quantitative appraisals permit the evaluator to assess a system and determine the benefits and limitations in an objective manner. This type of survey generally incorporates a statistical analysis. It provides a method to evaluate a system without introducing human biases which could taint the analysis and undermine effective decision making.

a. Modeling

Quantitative analyses often rely on models as the primary mechanism for conducting the analysis. A model is a simplified representation of the entity it imitates or simulates. (Hughes, 1984, p1) Analytic models are typically either simulations or wargames. Both may utilize computer resources to expedite data collection and analysis. The primary difference between simulations and wargames is that simulations are generally systemic. Human decision making is represented by preprogrammed algorithms which may be defined probabilistically. (Hughes, 1984, p42) Parameters are set

before the simulation begins or the simulation may be stopped to accept human inputs. This type of model has the benefit of ensuring that human biases and judgements are not introduced into the model; therefore, the results are a true reflection of the variables and their interactions in the model.

Wargames, on the other hand, incorporate human interactions into the model. Human participants are an integral part of the wargame model, and the variances they introduce are considered crucial and an important element in the model. Since the goal of this thesis is to evaluate the effects of Command, Control and Intelligence, the most appropriate model is the wargame because it incorporates the human factor.

Models can be classified as either high resolution or low resolution. In a high resolution model, a detailed view is achieved by representing individual combatants as separate entities. (Hartman, 1992, p1) A low resolution model, on the other hand, combines units of smaller size into a larger, more managable entity; however, this aggregation sacrifices model detail. For example, in a high resolution model the total remaining ordnance load of an aircraft strike group may be tracked by individual aircraft; however, in the aggregated (low resolution) model this may be tracked by an average amount of ordnance remaining in the entire formation. The model would not care that some aircraft were nearly out of ordnance while others may have a full load. (Hartman, 1992,

p3) Aggregated models also do not track information concerning event sequencing because they do not keep a record of individual actions. (Hartman, 1992, p3)

b. Model Determination

The two wargames that were available for use at the Naval PostGraduate School were the Joint Theater Level Simulations (JTLS) and the Research Evaluation Systems Analysis (RESA). Both simulations support human players; however, there are substantial differences between the two.

(1) Joint Theater Level Simulation (JTLS). JTLS is a stochastic, real time player interactive simulation of joint theater combat. (Hartman, 1992, p6) Since the basic unit in JTLS is a division or naval task force, it is an aggregated, low resolution model. The JTLS simulation requires a great deal of operator familiarity, and effective utilization requires numerous players. The requirement for more players and the time required to effectively train the players put unacceptable constraints on the usage of this model. Another important factor was the additional variances induced by having numerous teams of players. For these reasons, JTLS was not chosen as the model for this thesis.

(2) Research Evaluation System Analysis (RESA).

RESA is a computer-based simulation of the naval warfare environment that focuses on the command and control issues of a naval battle group. RESA is not

distinctly a low or high resolution simulation. It can support simulations from the theater level down to the single platform level with equal ability. The system is designed for human interactive decision making but also supports the ability to script forces for consistent actions in simulation replays. RESA was selected due to these features and the relative ease with which operators become familiar with system commands.

III. EXPERIMENTAL PLAN

A. INTRODUCTION

This experiment utilized 24 subjects from the Naval Postgraduate School (Appendix A). The subjects were chosen from both the staff and student population to obtain an adequate sample size. Each player participated in a wargame in which they were to act as the tactical commander and perform in a decision-making role during a specific scenario. Each simulation required only one person to play at a time to remove any variance of different groups in the decision-making process. Each simulation contained a particular level of information; however, the player was not aware of this until after completion of the run. Data were collected for each run for later quantitative analysis.

B. PURPOSE

1. Real World Problem

Modern warfare has evolved to a level in which the control of information has become the vital link to mission accomplishment. This type of warfare has been termed "Information Warfare", and has elevated the importance of the command and control systems in use today as well as those planned for the future. A commander's information system is now thought of as a weapons system used by the commander and

his staff instead of only a communications device. Technology is advancing at such a rapid rate that the commander and his staff require a system which meets various information requirements.

During the post Cold War era, a declining defense budget has forced complicated decisions concerning which systems the military will be allowed to procure. Command and control systems are more difficult to justify based on their function of bringing information to the commander. The problem is to determine the value of that information compared to the value of another weapons system. The concept of value is difficult to quantify for command and control systems using classical measures of effectiveness.

A wargame is one method to test the effectiveness of a particular factor based on the ability to run several replications of one scenario. The simulation can be totally automated, or it can involve human players. The latter type of wargame is also used in a training environment to sharpen skills prior to actual use in the real world environment.

2. Objectives

The primary objective of the experiment is to determine whether various levels of information affected overall results both offensively and defensively in a wargame simulation. In addition, the difference in performance of individuals from different warfare specialties was measured.

3. Approach

Subjects participated one at a time in a wargame in which they acted in a tactical decision making role on the side of the Blue Forces in a Naval Battlegroup scenario. The opposing force consisted of computer scripted files which were run in reaction to the Blue Force's actions. This procedure assumed the same opposition for a given size Blue Force maneuver. Performance data were collected in the form of readouts of the results of every shot taken during the course of the simulation. For this experiment, performance is defined as numbers of aircraft, such as the number of Blue aircraft, reaching the target and releasing ordnance (offensive). Defensive performance was measured by the number of Orange attack aircraft able to launch weapons at the CVBG. These data were then translated into a raw data table (Appendix B). The raw data table was then reduced to an analysis table for further quantitative analysis (Appendix C). The computer based statistical package personal computer version of Minitab was used as the prime analysis tool.

The two factors of primary concern were levels of information and tactical experience level. Information was divided into four different levels (very low, low, medium, and high). The two levels of tactical experience were Tactical Air and Non Tactical Air. Aircraft carrier fixed wing pilots and Naval Flight Officers were grouped in the Tactical Air level and all other subjects were grouped as Non Tactical Air

(Appendix D). The statistical outputs were analyzed to determine criteria for accepting or rejecting stated hypothesis to help in answering the questions posed by the experiment.

4. Anticipated Results

Offensive and defensive performance should increase within each community with each incremental increase in information level. Individuals from the Tactical Air community are expected to perform somewhat better than the Non Tactical Air individuals since they most likely have been exposed to more situations in which they made the types of decisions required in this type of wargame.

C. SCOPE OF THE EXPERIMENT

The Naval Postgraduate School Warlab facilities were used to conduct the simulations over a five week period. During each simulation, assistance was provided by the Warlab Manager to run specific script files for the Orange Forces. Additionally, two other warlab technicians were used to input the required software entries for the player for the entire duration of the wargame. This removed the requirement for the players to receive any prior training for the RESA wargame environment. The subject was only required to make decisions and all computer work was performed by the technicians.

D. EXPERIMENTAL DESIGN

1. Setup

a. *Physical*

The RESA wargame was used for all simulations, which consisted of three personal computer workstations in one bay of the Naval Postgraduate School Warlab. In addition, one large screen tactical picture was used, similar to those used in command centers. All players were familiar with the Tadil-J (Link-11) symbology which was used to represent various air and surface units.

b. *Test Subjects*

All participants were U.S. Naval Officers and had attained either a Surface Warfare Officer qualification or were from the Naval Aviation Community and designated Pilots or Naval Flight Officers. The subjects were divided into four groups, each receiving a particular level of information (Appendix D). The four groups consisted of an equal number of players from the Tac Air and Non Tac Air communities.

Each player had the baseline tactical knowledge required to actually participate in the experiment because all were familiar with the Link-11 symbology used in the wargame. There was no requirement that a player have previous wargame experience, but if he did, the learning curve was assumed negligible. Technical assistance for software entries was provided so the player only had to make tactical decisions.

This also removed any variance which would have occurred due to problems with players entering software entries at different rates based on their typing proficiency.

c. Schedule of Trials

Each player was given a hardcopy briefing report one day prior to their participation in the experiment. This report contained scenario background, the latest intelligence report, order of battle for both Orange and Blue Forces, along with a mission description statement and the Rules of Engagement (ROE). All information provided was unclassified since the RESA wargame is itself unclassified. Four separate intelligence briefs were used corresponding to the four information levels (Appendix E).

Each player was given a 30 minute face-to-face strike brief prior to actually entering the warlab. This time was used to supplement aspects of the game not covered in the briefing report and to answer any questions (Appendix F). General procedures for the flow of the wargame were discussed; however, details concerning what was being measured were not briefed until the completion of the simulation run.

After the initial brief, the subject was shown the equipment configuration and proper procedures used to control status boards as well as those used to control display information. This 15 minute period was used to familiarize each player with the simulated Command Center environment.

During this time, each player submitted to one of the lab technicians a list of aircraft to be used in the assigned offensive strike mission. This was done to enable the technician to begin inputting data entries to reduce the time required to complete the run.

The assigned mission for each player entailed conducting an offensive strike mission on a target in North Korea as well as maintaining an appropriate defensive posture (Appendix G). In the scenario the North Korean forces were supplied with TU-16 Badger aircraft to provide the Orange Forces with a capable platform providing a serious threat to the CVBG with the AS-5 (Kitchen) air-to-surface missile.

The scenario was designed to have the player develop a course of action for the airstrike(s) into North Korea. Once North Korean airspace was violated,the Orange Forces were scripted to launch alert aircraft in reaction to the position of the Blue Force's strike package aircraft. A scripted offensive strike from various airfields in North Korea was then launched in response to the Blue Forces aircraft (Appendix H). This required the player to develop a proper defensive strategy against raid aircraft. To help maintain the stress level for the player, each was required to also identify unknown air and surface tracks within a determined radius around the CVBG.

Additionally, three intelligence updates were provided to the player at pre-determined points during the

simulation (Appendix I). The content of the updates corresponded to the level of information received in the initial brief.

At the conclusion of the simulation, the player was debriefed on the outcome of his run and was asked to fill out a written debrief questionnaire to be used for qualitative analysis (Appendix J). The player was also told what information was being recorded as well as the goal of the experiment.

2. Hypotheses

- The level of information has no effect on a player's performance in a wargame.
- The player's warfare specialty has no effect on his performance in a wargame.

3. Assumptions

The following factors were assumed at the commencement of the experiment:

1. RESA is a valid model.
2. The data are independently identically distributed (iid) from normal populations with equal variances.
3. All players' skill levels regarding the symbology and terminology were the same.
4. There was no learning curve in effect, and if a player had played RESA before, any learning curve effect would be negligible.

4. Statistical Design of Experiment

The statistical design of the experiment included dividing the 24 participants into four groups with an equal allocation of tactical experience level within each group. The group assignments were made randomly (Appendix D). Data were recorded for a total of 24 simulation runs, with six runs in each resolution group.

5. Measures

Measurements focused primarily on aircraft attrition. The two primary measures were number of Blue strike aircraft reaching target and number of Red Force TU-16 Badgers reaching their weapons release range. Other measurements recorded how well players actually complied with the ROE. Player debriefs aided in qualitative analysis and provided insight into some of the players' decisions during the simulation (Appendix J).

E. INSTRUMENTATION

1. Warlab Manager

The Warlab Manager was involved early in the research to implement the authors' scenario in RESA. This involved inputting the correct Orange and Blue Forces into their respective units or bases. Computer script files were generated to provide all Orange Force movements, which were based on a tripwire system. During each simulation, the Warlab Manager was responsible for generating Orange Force response by the use of the script files (Appendix H). He performed

this function while manning a computer station in a separate area of the Warlab, which was not seen by the player. At this station he was able to constantly monitor the status of the entire game by the use of a computer network, which tied all RESA computers together. Additionally, he was responsible for the proper scheduling of the simulation runs and ensuring all required assistance would be available.

2. Navy Technicians

Two Warlab technicians were utilized during the simulations for inputting all software commands for the Blue Force player. The two U.S. Navy Operations Specialists had been assigned to the Warlab Staff, and both had extensive experience with the RESA Wargame. Having the same technicians enter the data for every run removed any variance from differences in typing abilities of the players. Thus, the players could concentrate on keeping track of the tactical picture, monitoring status boards, and making decisions.

Both lab technicians were responsible for the launching of all aircraft as per the player's orders. One technician coordinated the actual overland strikes and supporting strike support aircraft. The second technician coordinated all other aircraft (i.e., defensive combat air control, surface search aircraft, airborne tankers, and helicopters). The technicians were not in an advisory role for the player. They responded to questions by the player as to

aircraft and weapons status, but did not advise the player for any tactical decisions.

3. Authors' Roles

During each simulation, one author remained with the player to act in a staff role. He ensured the player had all the correct displays required, translated the player's commands into entries for the technicians, and answered questions concerning ROE and aircraft status. The second author remained in the back bay with the Warlab Manager to ensure the proper computer script files had been executed and to act as a liaison with the player computer bay.

F. MODEL VERIFICATION

1. Testing

Once the computer script files were written and coded, an extensive testing period was required to ensure the model performed as expected. This period lasted approximately two weeks. It consisted primarily of changing numbers of Orange aircraft at various bases and refining Orange air-strike compositions.

2. Pilot Trials

The final testing phase for verification consisted of actually running the simulation with players. First, the authors played RESA and attempted to use as many different strike routes as possible to ensure all script files were sufficient in providing a reasonable force in relation to one

CVBG. Next, one player was brought in to play, and his run was used to determine if the simulation was valid. His run was not used in any analysis. After the final pilot trial, the technicians and the Warlab Manager had participated in six practice runs and were extremely proficient at all software commands the game required.

G. DATA DESCRIPTION

1. Description of Scripted Scenarios

The computer script files were based on a tripwire system and were executed in response to the actions of the Blue Forces. The initial scripts were based on surveillance rings around North Korean bases. When Blue Force aircraft arrived inside these rings, intercept aircraft were launched. Additional script files were written to add commercial air traffic and North Korean military training flights into the simulation. The final script files created a three axis Orange Force offensive action on the Carrier Battle Group (Appendix H).

2. Data Collection

Data were collected primarily by computer resources in the form of an engagement log which kept track of all aircraft losses (Appendix K). In addition, an aircraft tally log was maintained which included strike package numbers as well as the mission for each aircraft (Appendix L).

3. Data Collection Problems

There were three runs which had to be excluded because of data collection problems. The authors felt the data were invalid for the three runs because of a misunderstanding of orders. Consequently, the player's forces either suffered excessive attrition rates or attrited excessive Orange Forces. The problems were technical in nature and were no fault of the player, so the data were deemed unusable. Because of this problem, out of the 27 runs actually completed, only 24 of the runs were counted in the analysis portion.

IV. ANALYSIS

A. ANALYSIS PLAN

The data were analyzed both quantitatively and qualitatively. The quantitative approach was twofold. First, statistically significant correlations between the two different warfare communities and the four levels of intelligence information were determined. Second, a mean value differential analysis was performed on applicable factors to assess the relative amount of change in the measures of effectiveness with regard to warfare community and intelligence information level.

The qualitative approach consisted of subjectively reviewing the Player Debrief Forms (Appendix J) to determine if any trends existed in the planning and execution of individual player strategies. This method permitted the interjection of likely reasons to explain the results of the quantitative analysis.

B. PROCEDURE

The analysis methods described above were employed to determine what effects warfare specialty and intelligence information levels had on the ability of a CVBG commander to successfully conduct an air strike against a land target while simultaneously maintaining an active CVBG defensive posture.

First, Measures of Performance (MOPs) are discussed to provide a baseline for player performance. Second, important Measures of Effectiveness (MOEs) are derived from the MOPs to accurately reflect player effectiveness in mission attainment. This established the relationship between the data collected and the MOEs identified. Third, the investigation methodology is outlined to establish the format of the analysis. Finally, the analysis was performed to gain insight into the research questions.

1. Measures of Performance (MOPs)

MOPs indicate the performance level of a system or collection of systems in accomplishing its designed task. In the RESA simulation these attributes are reflected in the various status tables available during the game. In addition, various summaries are compiled at the completion of play for further review. These summaries are described below.

The Detection Log is a record of all radar, electronic and visual observations identified by both forces. It is, therefore, a reflection of a platform's identification system performance.

The Position Log chronicled the geographic position of every unit at various points in time. This log is an indication of an element's tracking system performance.

The Engagement Log provided a record of every engagement between Blue and Orange forces. The data included

time of engagement, forces involved, weapons utilized, hits or misses and targets destroyed. This log is an indication of a unit's targeting system and engagement performance.

2. Measures of Effectiveness (MOEs)

MOEs can be thought of as indicators that reflect "how much" better one system is compared to another. (Thomas, 1985, p1) Generally, one MOE cannot adequately characterize all the actions and interactions that take place among the principle variables; therefore, several MOEs are often utilized to help describe the behavior of the variables. For this reason MOEs should not be considered as solely measures of optimization, but also as measures that indicate degrees of variable interactions. (Thomas, 1985, p6) Recall that the following research questions posed for analysis in Chapter I were as follows:

- What is the effective improvement or degradation, if any, to the striking capability of the battle group if C⁴I is improved?
- What is the effective improvement or degradation to the defensive capability of the battle group if C⁴I is improved?
- How effective is C⁴I as a Battle Group Force Multiplier in a Littoral Environment?

In order to effectively answer these questions, MOEs that correctly measure the degree of change in offensive and defensive capabilities are important. Once these capabilities

are determined, the results can be aggregated to reflect the effectiveness of C⁴I as a Force Multiplier.

The relevant MOEs derived from the Engagement Log were as follows:

(1) Number of strike aircraft reaching target

(2) Number of strike aircraft reaching target based on the number of strike packages

(3) Percent of strike aircraft reaching target

(4) Percent of strike aircraft reaching target based on the number of strike packages

(5) Number of Orange Badger aircraft attrited prior to weapon release point

(6) Number of Orange Badger aircraft attrited prior to weapon release point based on the number of defensive (CAP) aircraft launched.

The first four MOEs directly measure the offensive capabilities of the player and thus will be used to analyze the first research question. The last two MOEs measure the defensive skill of the player and will be used to examine the second research question. The final question will be answered by aggregating the first two MOEs into an overall effectiveness measure.

3. Analysis Factors

Each of the above listed MOEs were applied with regard to warfare specialty and information level. Since only two warfare communities were utilized, this approach was straightforward. Information levels were considered in the four

specified levels and also by combining the two lowest tiers (level 0 and 1) and the two highest tiers (level 2 and 3) for a total of two levels. This was done primarily because there was a distinct break in the quality of information provided between level 1 and 2. This difference in information primarily related to detection and engagement ranges as well as more accurate information on enemy force quantities and locations (Appendix E).

Additionally, the number of air intercepts/escorts and surface contact identifications was analyzed to evaluate how well the ROE was followed. A final study was conducted to ascertain the importance of the intelligence brief/updates provided to the players.

C. METHODOLOGY

Appendix M contains a comprehensive analysis of the data collected. Numerous one-way analyses of variances (ANOVAs) were conducted to determine if statistically significant relationships existed. Most of the ANOVAs did not reveal significant differences between the variables. Although twenty-four subjects participated in the experiment, they were effectively divided into eight groups (Appendix D). This reduced the sample size of each group to three; therefore, statistically significant values could not be expected with such a small sample size. In order to further analyze the data for trends, a mean value differential analysis was

performed, allowing the differences in means to be evaluated. Charts depicting various relationships were also utilized when necessary to emphasize significant trends.

The following summary briefly explains the format of the analysis methodology and layout of Appendix M. The first MOE (number of strike aircraft reaching target) will be used as an example to describe the procedure utilized in the analysis of all MOEs.

1. Analysis of Variance (ANOVA)

The first step was to utilize the one-way ANOVA to analyze the variances on the MOE with regard to warfare specialty and information level. Information level was evaluated for both communities combined and separately (Appendix M, Sections A through D). The relevant hypotheses for part A are as follows:

- H_o: The mean number of aircraft reaching the target is the same for both communities, i.e., the means are equal.
- H_1: The mean number of aircraft reaching the target is <u>not</u> the same for both communities, i.e., the means are not equal.

The question that the hypotheses address is: "Are these outcomes the same?"

The important features of the ANOVAs are the mean values, confidence intervals and P-values. The mean number is simply the average value observed for the particular treatment level. In this example the mean number of aircraft reaching

the target was 18.583 and 18.167 for the TACAIR and NON-TACAIR communities, respectively (Appendix M, Section A).

The confidence intervals are all based on a 95% level of confidence which means that the probability is 95% that the interval includes the true mean value. In this example the observed mean values are depicted on the confidence intervals and the range of the intervals represent the area in which the true value lies with probability of 95%. The issue is whether or not these intervals overlap. If they do, then the result is that there is no difference between the numbers; however, if they do not overlap, then the numbers can be judged different.

The P-value represents the lowest level of significance at which the null hypothesis can be rejected. In other words, it is the smallest level at which the results are significant. In this example these numbers could be judged different if a 10% level of confidence is acceptable, since the P-value is 0.898. This value is obtained by subtracting the P-value from 1.

In the analyses of all the MOES, a confidence interval of 95% was selected and thus the P-value has to be less than or equal to 0.05 for the determination that there is a difference between the treatment values.

2. Mean Value Differential Analysis (MVDA)

The next step was to examine how much deviation there was between the observed value and the mean. This permitted the observation of important, although not statistically significant, trends. This analysis was performed only for information levels since the differences from the mean for warfare specialties is easily recognizable. This analysis was performed for both four and two levels of information.

3. Graphs and Charts

Appropriate graphs and charts were utilized to supplement the ANOVAs and in some instances in place of the mean value differential analysis and are contained in Appendix M. This was the case in the examination of the number and percentage of aircraft arriving on target with regard to strike packages launched, and with the number of Badger aircraft destroyed based on the number of CAP aircraft launched. In these instances the graphs and charts more clearly depict the significant trends.

D. RESULTS

1. Number of Strike Aircraft reaching the Target

This value was utilized to measure the actual amount of ordnance placed on the target. Since the ordnance loadout of each type aircraft was pre-determined (Appendix E, Section E), the amount of ordnance delivered was directly related to the number of aircraft arriving on target. The effects of

warfare specialty and information level were examined to assess their impact on the number of aircraft reaching the target.

a. Warfare Specialty

The mean number of strike aircraft reaching the target was not solely dependent upon the community. The ANOVA did not show any statistically significant relationship. In fact, both communities were able to put slightly more than eighteen aircraft over the target (Appendix M, Section A).

b. Information Level

The importance of information, although not statistically significant, had an impact. A mean differential analysis showed an increase in the mean number of aircraft reaching the target as the information level increased (4 levels). The mean differential analysis for the first MOE is summarized in the table of Appendix M, Section E. The grand mean is the mean value of the entire population (all twenty-four values). This value is divided into three mean values representing combined, TACAIR and NON-TACAIR. These values are the mean of means for each of the three categories and are derived from section B through D, respectively. For example, the mean number for the TACAIR community is 18.583 which corresponds to the value obtained above in the ANOVA, warfare specialty analysis. This number is also the mean number from the four information levels of part C. The mean differential

is obtained by comparing the mean value from each information level with the mean from its respective community. For this example the mean for TACAIR level 0 is 18.00 which is 0.583 less than the mean for TACAIR, thus the differential for information level 0 is -0.583. All other values are obtained in a similar manner. This analysis highlights the fact that an increasing trend in the number of aircraft reaching the target from each warfare community individually and combined occurred as the information level increased up to level 2; however, the value decreased for level 3. It also shows that the NON-TACAIR community experienced the greatest improvement and least degradation since the differences between levels was greatest between 0, 1 and 2 while at the same time less between 2 and 3. Figure 1 is from Appendix M, Section E and is reproduced below.

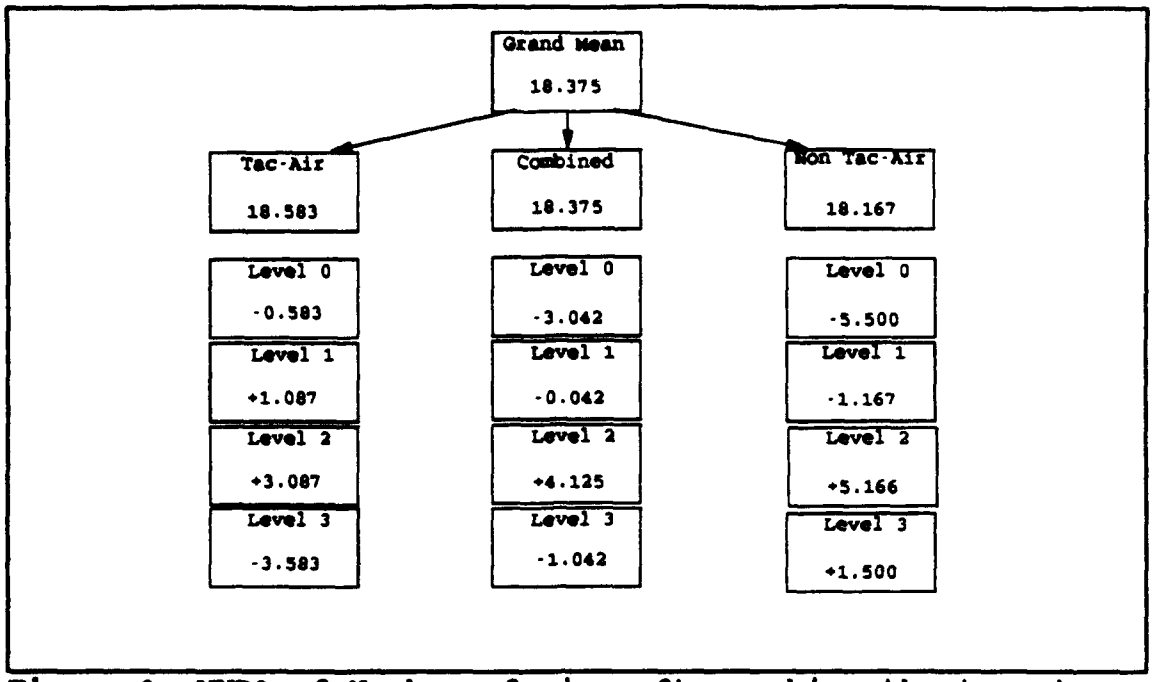

Figure 1: MVDA of Number of aircraft reaching the target based on four information levels.

The mean number of aircraft reaching the target increased from the mean value for both communities combined and individually up to information level 2; however, the value decreased at level 3. This result was contrary to what was expected. It was anticipated that the performance would steadily increase as information level increased. The reason for this is not totally clear; however, some possible reasons are discussed.

The explanation might be attributed to the number of strike packages launched. It was noticed that individuals that launched more strike packages tended to lose more aircraft (MOE 2). Another factor may be because the player did not have a staff to help him manage the intelligence data

and track symbology. A third reason may be due to the random distribution of players into the four categories. The level 3 participants may have had a "lower" skill level than the rest of the population.

The results for two information levels, on the other hand, were significantly different. The NON-TACAIR community showed an improvement in the number of aircraft reaching the target but the reverse was true for the TACAIR community. Figure 2 from Appendix M, Section I is the mean differential analysis. This might also be attributed to the number of strike packages launched.

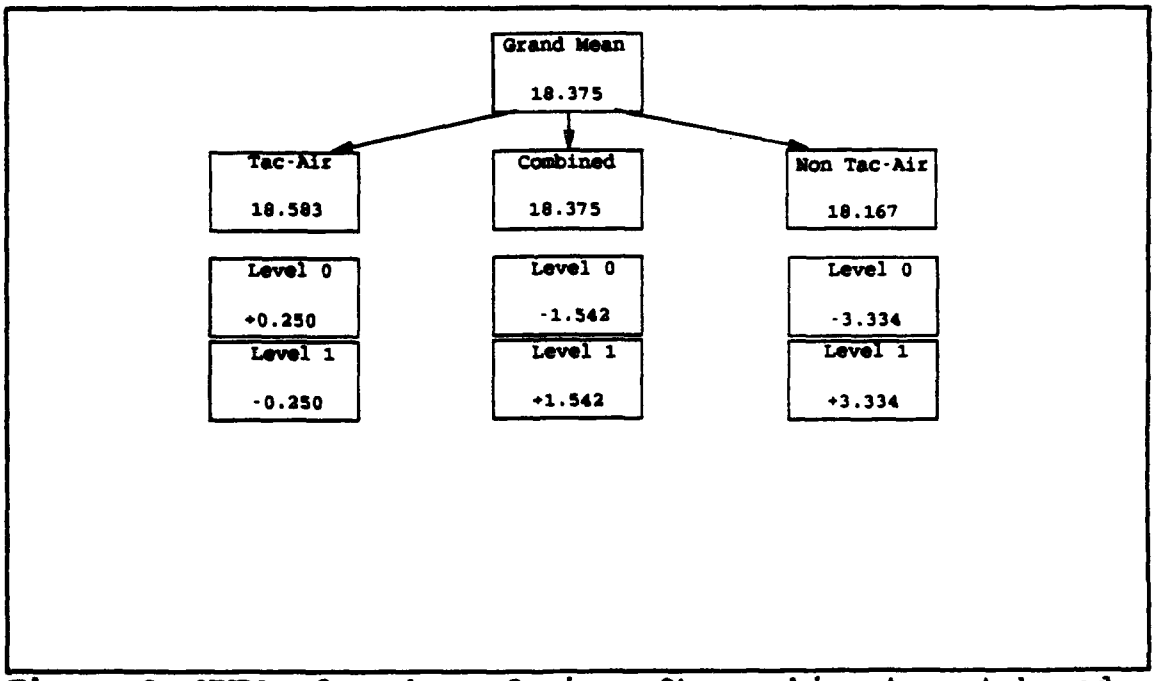

Figure 2: MVDA of number of aircraft reaching target based on two information levels.

2. Number of strike aircraft reaching target based on the number of strike packages

As the number of strike packages launched increased, the number of aircraft reaching the target decreased (Appendix M, Sections S through AL). Figure 3 is from Appendix M, Section Z and shows the relationship between aircraft reaching the target and strike packages launched for both communities combined.

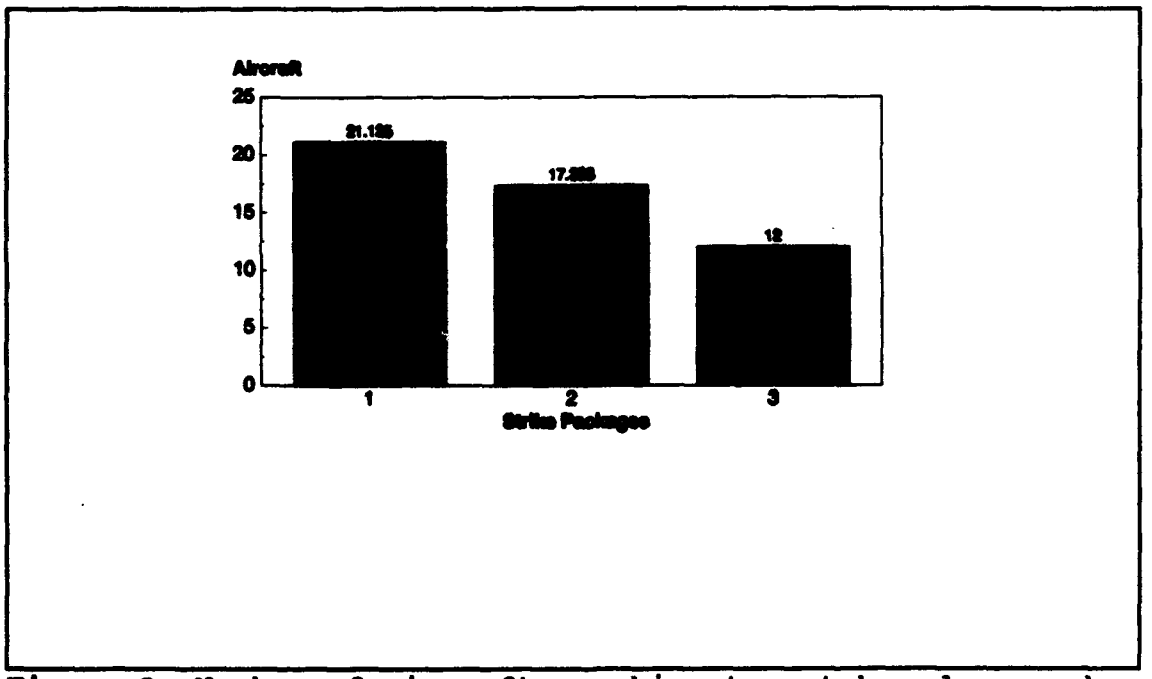

Figure 3: Number of aircraft reaching target based on number of strike packages launched.

a. Warfare Specialty

The mean number of strike packages launched was dependent upon the community. The TACAIR community launched

a mean of 1.5 strike packages compared to the 1.917 from the NON TACAIR (Appendix M, Section T and AA).

b. Information Level

The number of strike packages launched by each community was affected by the information level received. The TACAIR community had less variance in the number of strike packages launched as information level increased. The mean number launched was 1.67 for levels 0, 1 and 3, and 1 for level 2 (Appendix M, Section AB). This resulted in a noticeable increase in the number of aircraft on target at information level 2 (MOE 1 analysis). The NON TACAIR community had more variance in the number of strike packages launched as information level increased. The mean number launched was 2, 2.33, 1.67 and 1.67 for levels 0 through 4, respectively (Appendix M, Section AC). The larger difference in the mean number of strike packages launched between level 1 and 2 contributed to the larger mean value differential as described in the MOE 1 analysis. An interesting fact is that, except for the one instance when three strike packages were launched, this community was able to get more of their aircraft to the target (Appendix M, Section U through Y, AB and AC).

The analysis when based on two information levels illustrates that both communities launched fewer strike packages as the information level increased and thus were able

to put a greater number of aircraft on target. The difference in the number of packages launched from the NON-TACAIR community was greater than for the TACAIR community as the information level increased. This difference highlights why the NON-TACAIR community exhibited more improvement in getting the strike aircraft to the target (MOE 1 analysis). Figure 4 is from Appendix M, Section AL and depicts this result.

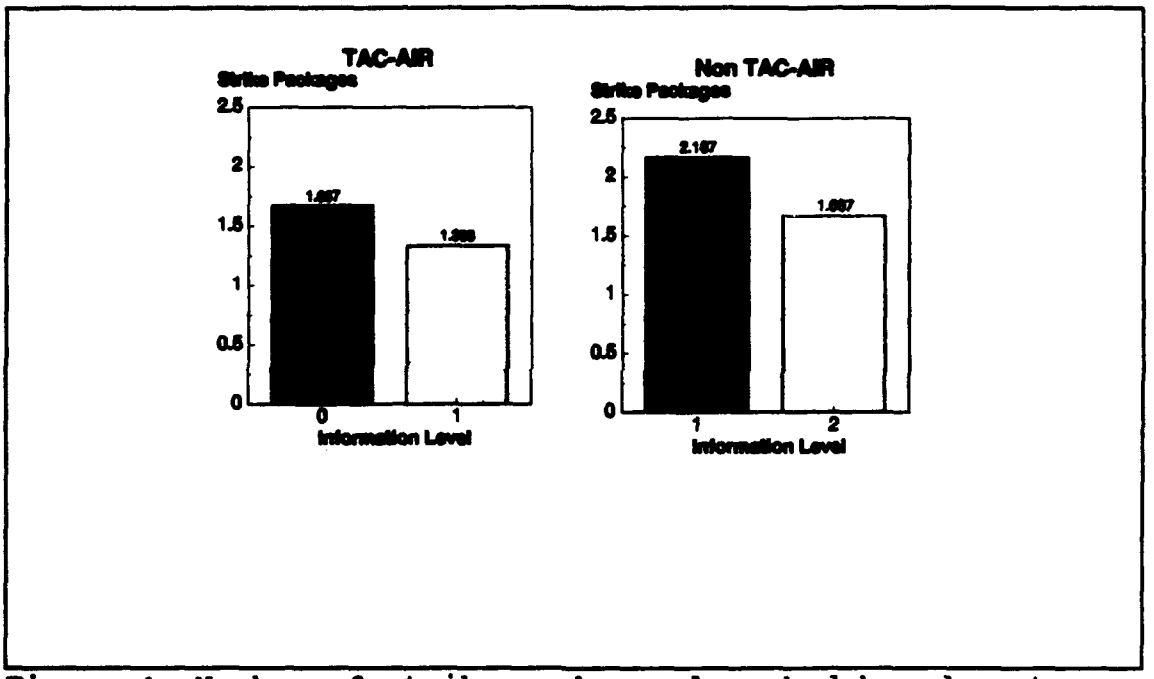

Figure 4: Number of strike packages launched based on two information levels (both communities).

In both cases (4 levels and 2 levels) as the number of strike packages increased the amount of effort required to manage the strike groups expanded. This caused many players to "lose the big picture" and inhibited their ability to effectively manage the strike packages.

3. Percent of strike aircraft reaching target

This MOE is utilized because it provides a different aspect on overall performance in getting strike aircraft to the target. The actual number of strike aircraft launched varied from 8 to 34 aircraft; consequently, the number reaching the target can be misleading as to the player's actual performance. For example, suppose player "A" launched 10 aircraft and 9 reached the target, and player "B" launched 30 aircraft and 15 reached the target. Based on the number of aircraft, player "B" did better, but he lost 50% of his aircraft while player "A" only lost 10%. Unfortunately the percent of aircraft reaching the target does not give any indication of how many aircraft were launched, or reached the target, and thus how much ordnance was dropped. Nonetheless, it is an important MOE.

a. Warfare Specialty

The mean percent of strike aircraft reaching the target was dependent upon the community. Although the ANOVA did not show a statistically significant relationship, a definite difference was noted between the communities. The TACAIR community's performance was 13% better (Appendix M, Section J).

b. Information Level

Information level was an important factor in determining the percentage of strike aircraft reaching the

target. The mean value differential analysis showed an increase in the mean percentage of aircraft reaching the target as the information level increased (4 levels) with the highest increase occurring at information level 2. Figure 5 is from Appendix M, Section N and shows this result.

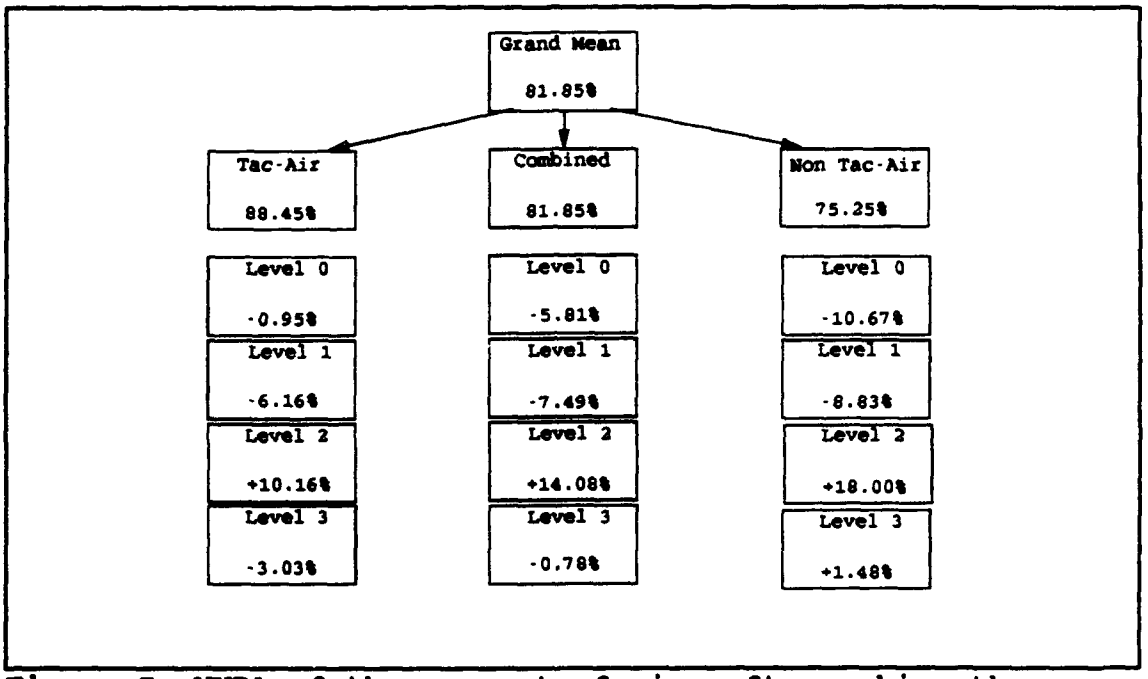

Figure 5: MVDA of the percent of aircraft reaching the target based on four information levels.

Again, the player performance at level 3 decreased slightly from the previous level. The possible reasons for this may also be attributed to those discussed in the previous MOE.

The results for two information levels was similar although not as dramatic (Appendix E, Section R). As was the case in the number of aircraft that reached the target, the NON TACAIR community showed the greatest improvement.

4. **Percent of strike aircraft reaching target based on the number of strike packages**

The percentage of aircraft arriving at the target was similar to the number when based on the number of strike packages launched; that is, a higher percentage reached target with less strike packages. Figure 6 is from Appendix M, Section AP and shows the percentage of aircraft with regard to the number of strike packages.

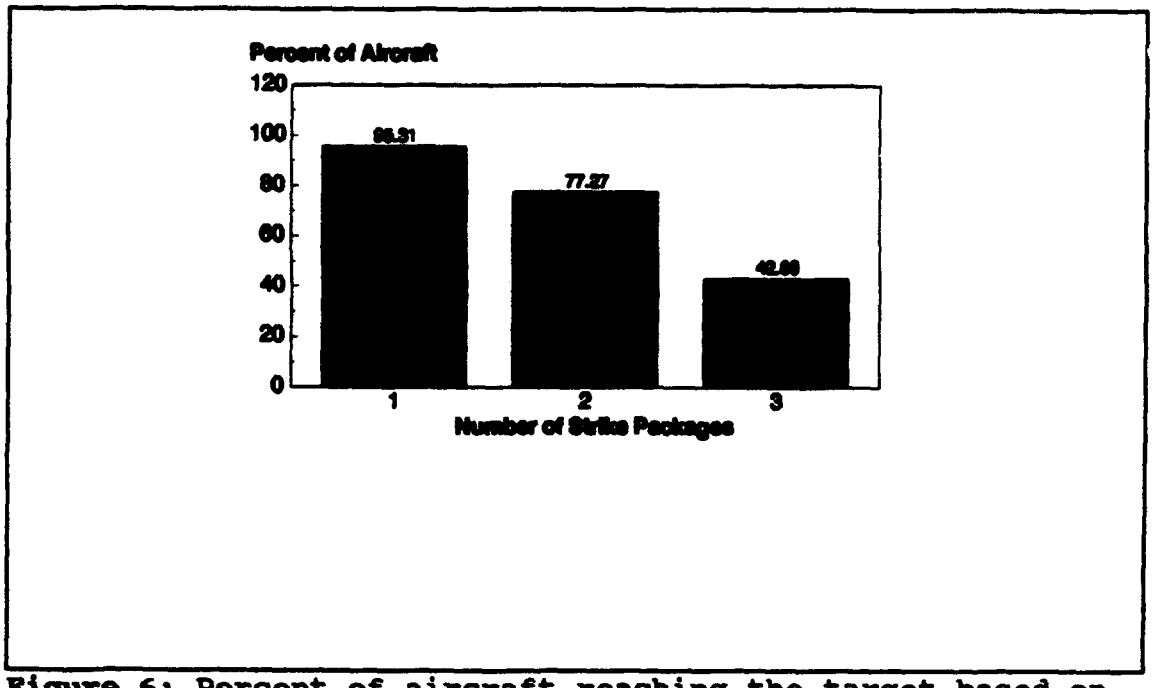

Figure 6: Percent of aircraft reaching the target based on number of strike packages launched.

a. ***Warfare Specialty***

The percentage of strike aircraft reaching the target was also dependent upon the community; however, in this

case the TACAIR community did appreciably better when one strike package was launched and slightly better when two were launched. Figure 7 is from Appendix M, Section AQ and shows the relationship between percentage of aircraft arriving on target and strike packages launched for both communities.

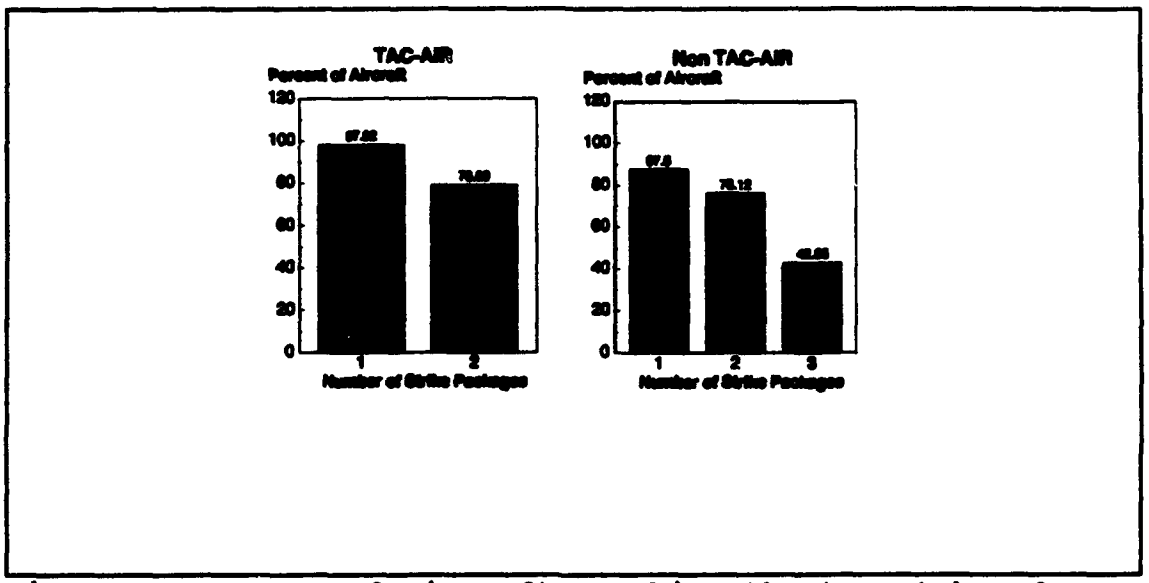

Figure 7: Percent of aircraft reaching the target based on the number of strike packages launched.

b. Information Level

Information level has no bearing on the percent of aircraft reaching the target since information level only affects the selection of the number of strike packages launched. See MOE 2 for analysis of the effect of information level on the number of strike aircraft reaching target based on the number of strike packages.

5. **Number of Orange Badger aircraft attrited prior to weapon release point**

The defensive expertise of the players was primarily measured by the number of Orange Badger aircraft destroyed before reaching their weapon release point. The total number of Badger aircraft launched to attack the CVBG was fifteen aircraft for every scenario. The Badgers conducted a three axis strike as outlined in Appendix H.

a. Warfare Specialty

Neither community eliminated significantly more aircraft than the other. In fact, both warfare specialties destroyed slightly more than five Badgers (Appendix M, Section AR).

b. Information Level

The number of Badgers killed based on four levels of information was slightly better at level 1 for the TACAIR community and partially better at level 2 for the NON TACAIR community (Appendix M, Sections AS through AV). Figure 8 is the mean value differential analysis from Appendix M, Section AV and shows the result. The possible explainations for this level 3 result are the same as those previously outlined.

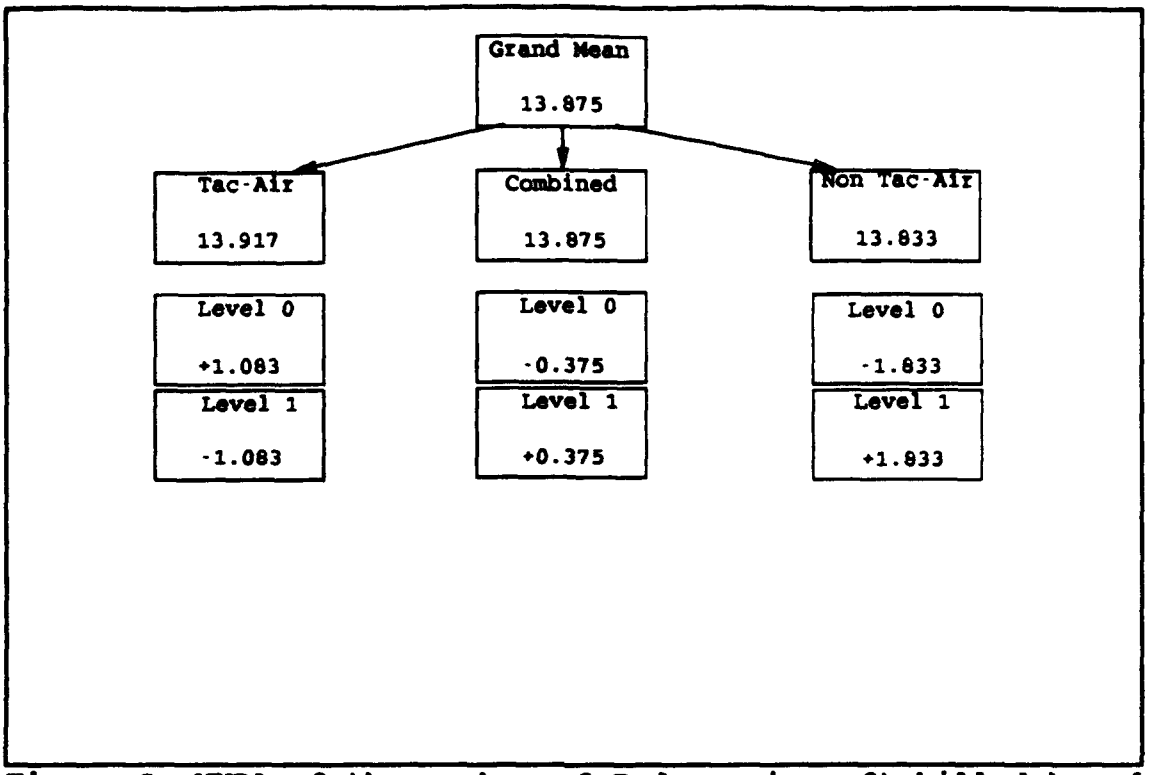

Figure 8: MVDA of the number of Badger aircraft killed based on four information levels.

The results based on two information levels is even less significant (Appendix M, Section AZ).

6. **Number of Orange Badger aircraft attrited prior to weapon release point based on the number of defensive (CAP) aircraft launched**

This MOE was selected because it measures the number of Badger aircraft attrited as a function of CAP aircraft launched. As the number of CAP aircraft launched increases, the number of Badger aircraft destroyed should increase (Appendix M, Section BA through BK). Both communities

combined launched between eight and twenty-four aircraft. Figure 9 is from Appendix M, Section BA and BF and depicts the result.

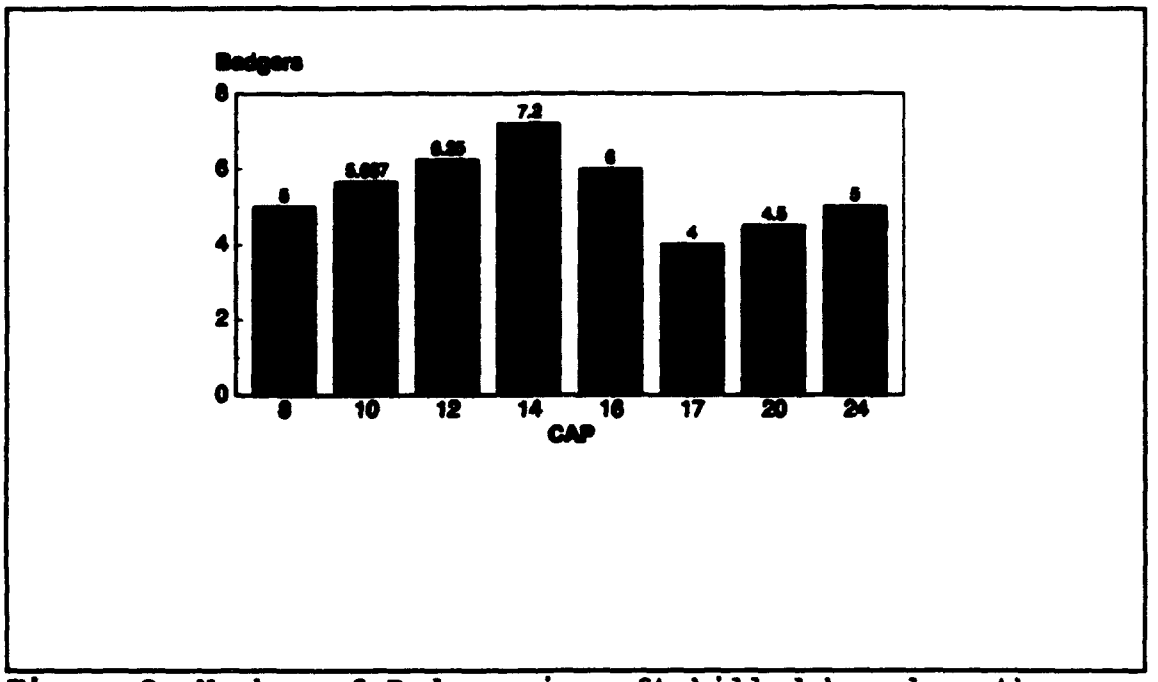

Figure 9: Number of Badger aircraft killed based on the number of CAP aircraft launched.

a. Warfare Specialty

The mean number of CAP aircraft launched for both communities was slightly more than thirteen (Appendix M, Section BB).

b. Information Level

The TACAIR community launched slightly more CAP aircraft at information level 1 and 3 and slightly less at information level 2 (Appendix M, Section BD). The NON TACAIR

community was consistent with the previous analyses by launching an increasing amount of CAP aircraft as the information level increased peaking at level 2 and then decreasing slightly at level 3. Figure 10 is the mean differential analysis and depicts the results.

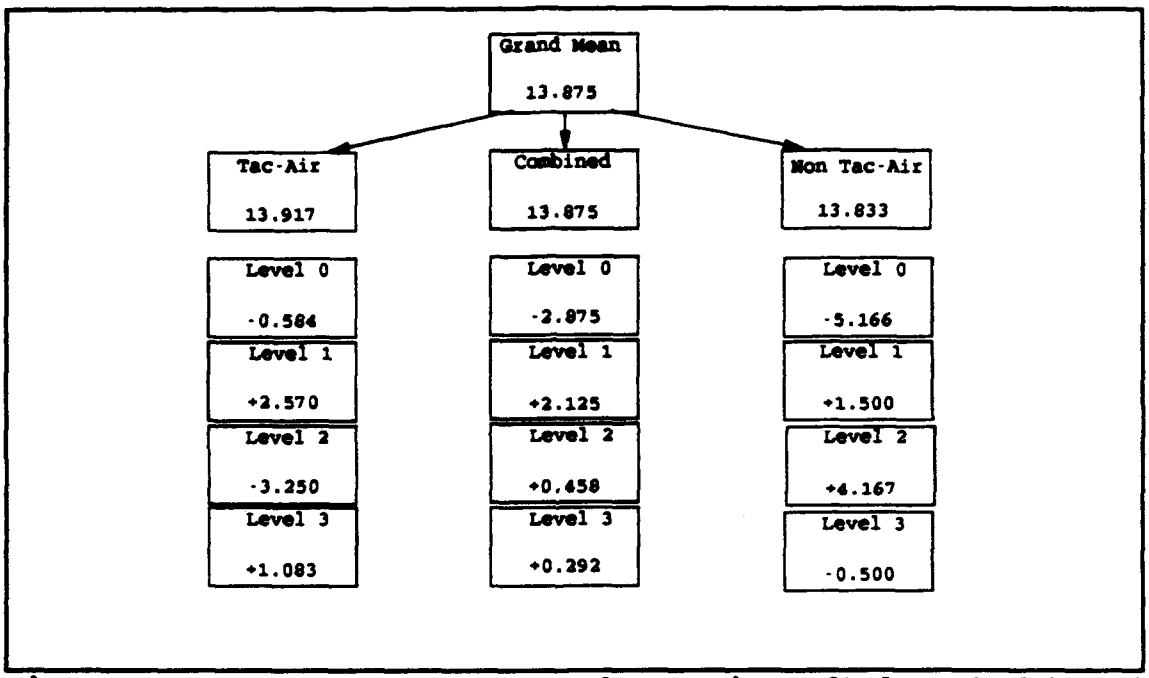

Figure 10: MVDA of the number of CAP aircraft launched based on four information levels.

The results based on two information levels actually show that the TACAIR community launched less CAP as the information level increased while the NON TACAIR community launched more (Appendix M, Sections BH through BK). Figure 11 portrays this result. Although there was no clear reason why this occured, a possible explanation may be that the TACAIR players felt they had a better understanding on the amount of

CAP aircraft that would be required to adequately protect the CVBG. The NON TACAIR players, on the other hand, may not have felt comfortable with the number of CAP aircraft that would be required and, therefore, launched more.

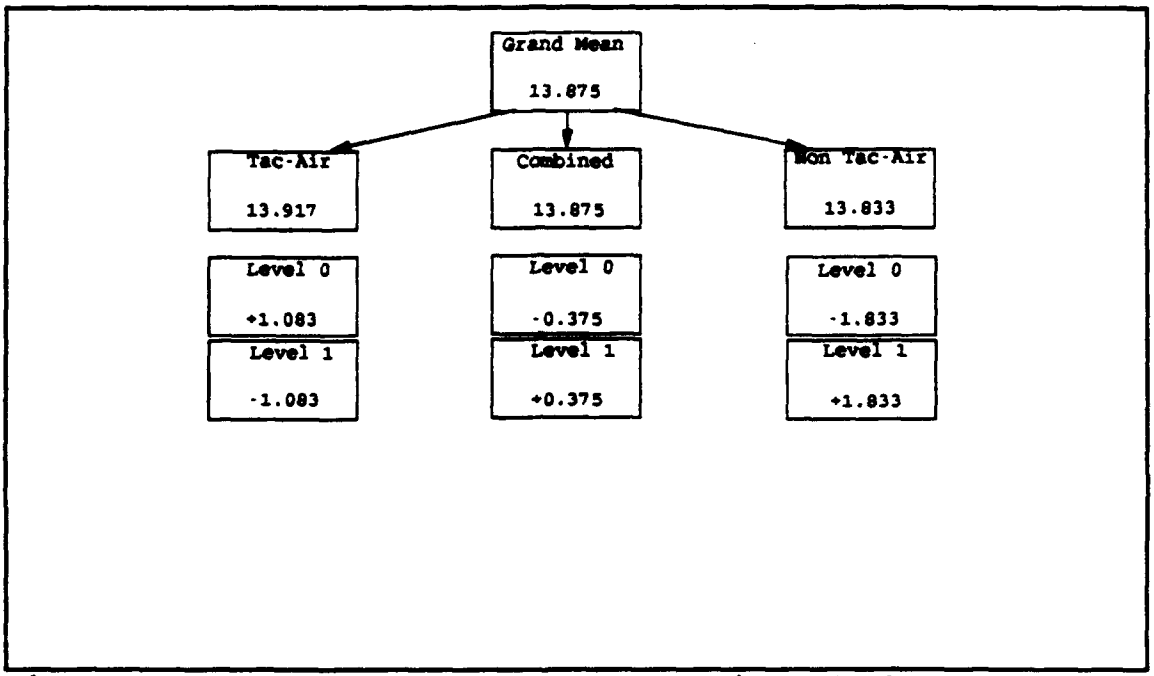

Figure 11: MVDA of the number of CAP aircraft launched based on two information levels.

E. RULES OF ENGAGEMENT

Rules of engagement were established for two reasons. First, they provided structure to the game ensuring that all players followed the same engagement procedures (Appendix D, Section C). Second, it was utilized as a secondary MOE to evaluate the player's command and control ability with regard to defensive force management. The player was required to

identify selected airborne and surface contacts. This demand kept the player busy while the strike package was being assembled and enroute to the target as well as added a degree of realism to the scenario.

All players complied with the ROE with regard to engagements and no significant deviations were observed. It was also expected that there would be no difference in the number of unknown contacts identified. The result was that neither community performed better than the other in contact identification. In fact, the mean number of contacts identified for both communities was exactly 8.75 each (Appendix M, Section BL). The mean value differential analysis based on four and two levels of information did not show any appreciable difference as information level varied (Appendix M, Sections BM through BO).

F. INFORMATION BRIEF RELEVANCE

The factors contained in the "Initial Intelligence Brief" were examined for relevant information to player strategy development. The initial brief contained background information and was constant in all levels of information; however, the specific information about Orange defensive strategy and the composition of forces at each base varied among levels of information (Appendix E, Sections B through E). Each brief contained pertinent information in the following six areas; aircraft, surface-to-air missiles (SAM),

radar surveillance, defensive strategy, operational communications and logistic information. During the debrief, each player was queried about the relevance of each type of information and asked to rank the importance of each. The most important factors identified were SAM information, aircraft data and radar surveillance information. Although there was some minor deviations in the exact ranking of each factor with regard to community and information level, these three clearly were most important (See Appendix M, Sections BP through BR for further details).

G. QUALITATIVE ANALYSIS

This analysis consisted of reviewing all the players' post mission debriefs for trends. This form was divided into two major sections: Mission Planning and Intelligence Data (Appendix J). First, the data were examined based on warfare specialty to determine if either community's strategy was different. Second, the data were evaluated based on information level. The data were also analyzed based on warfare specialty and information level but there was not any significant differences noted.

1. Warfare Specialty

Both communities' choice of ingress route(s) were based on the desire to avoid major population centers and military installations, and minimize the amount of time that the strike package(s) were in enemy territory. Specific

attention was given to radar, SAM site and enemy fighter aircraft avoidance.

The number and type of aircraft selected for the strike package(s) was also similar for each community. The desire to inflict maximum damage and provide sufficient support for the attacking aircraft were uniformly stressed. Both communities also placed significant emphasis on defense of the CVBG; however, this concern was slightly greater in the NON-TACAIR community.

The selection of strike aircraft egress route(s) was common between communities. The over-riding factor was the desire to take the shortest, most direct path to expedite the egress. The NON-TACAIR players were more likely to modify their egress plans and take different routes if significant opposition was encountered on the primary route. The TACAIR players were more likely to utilize their pre-determined route even if strong opposition was encountered.

Both communities were also similarly satisfied with the initial intelligence briefs and considered them helpful in strategy planning. Neither warfare specialty considered the intelligence updates especially essential; however, the TACAIR players felt they were slightly more helpful than did the NON-TACAIR people.

2. Information Level

Ingress route(s) were selected to expedite the strike and minimize the amount of time in enemy territory. The route(s) utilized sought to avoid population centers and military bases. As the levels of information increased, the players incorporated the increased knowledge about the enemy disposition into their ingress plan; however, this did not appreciably alter the route(s) selected; a direct route was still preferred.

The number and type of aircraft selected for the strike did not vary significantly between information levels. Maximizing ordnance placed on target was emphasized and protection of the CVBG was considered; however, the players with the "Low" information level expressed the greatest concern for CVBG defense.

Selection of egress route(s) was influenced by the desire to utilize a direct route which provided the quickest path to exit the enemy country. No specific group demonstrated any significant desire to alter their route as the information level increased.

The usefulness of the initial intelligence brief and update messages varied from each level. The players in the "Very Low" and "Low" categories felt the information lacked details with regard to enemy type and number of aircraft, radar ranges, SAM sites and defensive strategy; therefore, they did not feel the information provided helped them perform

the mission. The update messages provided information that something was happening, but was not specific enough to alter postures. The "Medium" and "High" level people were more supportive of the value of the initial intelligence brief. They were provided with more details and thus were able to glean more valuable information from the brief; however, this information did not significantly alter the selection of ingress of egress route(s). It did give a more complete picture of the opposition and the updates were more valuable in that they provided a better warning about the retaliatory strike. Unfortunately these groups did not perform any better with regard to destroying the attacking Badger aircraft, nor did they get more aircraft over the target, especially at level 3.

V. CONCLUSIONS AND RECOMMENDATIONS

A. ANTICIPATED RESULTS

The purpose of the experiment was to determine if tactical performance in the RESA wargame was different with respect to information provided as well as trying to determine if the members of the Tactical-Air community performed any differently than the Non-Tactical-Air community. Prior to the experiment, the authors expected that there would be an incremental improvement in both offensive and defensive performance within each of the warfare communities as the level of information increased. It was also anticipated that the players with more Tactical-Air experience would have better results than those players in the Non-Tactical-Air category. The following conclusions will attempt to explain the three primary research questions stated earlier, as well as suggest some possible reasons for results that differed from what was anticipated by the authors.

B. CONCLUSIONS

1. Offensive Performance

The offensive performance of all players was determined by examining the first four MOEs defined in Chapter IV. These MOEs measured the total number of strike aircraft reaching the target, percentage of strike aircraft reaching

the target, as well as both of these categories based on the number of strike packages launched.

The analysis indicates that warfare specialty had no effect on the total number of strike aircraft to actually strike the target. However, since each player chose both the size and number of the strike packages required to accomplish the mission, the total number of aircraft to reach target as well as percentage of the strike aircraft launched to actually reach target are both important. Both communities were able to get approximately the same mean number of aircraft to the target. However, with percentage of aircraft over target being a function of number of strike aircraft initially launched, the TACAIR community was able to get 13% more aircraft over target, which indicates the NON TACAIR community suffered greater losses on ingress routes. One of the most prominent differences in the warfare communities appeared in the number of strike packages used by each. The Non-Tactical-Air community tended to use more strike packages than the Tacair community, and the analysis indicates that as a player used more packages, his offensive performance tended to decrease.

Overall, as the level of information increased, the total number of strike aircraft reaching target and percentage of strike aircraft reaching target both increased, however, the increase was not in an incremental fashion as was anticipated prior to the experiment. Generally the first three levels exhibited an increase, however, the results of the

highest level of information dropped off slightly. As previously discussed, the authors are unable to explain exactly why this occurred, but suspect that the players might have experienced "information overload", in which too much information was supplied to the commander during the game, and the players were unable to maintain the proper situational awareness. From direct observation during the simulation runs, the authors did notice that it seemed as if players in the highest information level did encounter "information overload" at approximately the same point in the simulation, due to the length of the information update messages.

Information flow to the commander also influenced the number of strike packages used by the player. As the level of information to the commander increased, he tended to use fewer strike packages. This trend appeared in both communities, but was more predominant in the Non-Tactical-Air community. Players who were given a lower level of information tended to use more packages. The authors suspect the extra packages were possibly used to counter unknown threats that the players were unsure about due to the poorer levels of information provided them. With a higher level of information flow to the commander, it appears that assets were used more effectively in accomplishing the mission. This in essence is an example of information systems acting as a force multiplier for the commander. The commander was able to achieve better results

(in this case, more ordnance on target), with a given set of forces, when his level of information flow was increased.

2. Defensive Performance

Defensive results differed from those anticipated prior to the experiment. Analysis indicates that neither warfare community was able to achieve a better defensive posture against a formidable threat to the CVBG in the RESA simulation. Both communities were able to attrite about the same number of Orange attack aircraft prior to the release of their weapons.

Information level also tended to not affect the players' defensive results. No specific trends are apparent in the mean number of Orange attack aircraft attrited prior to weapon launch. This result was also different from what the authors had anticipated prior to the experiment, so further analysis was performed to examine possible reasons for no difference in defensive results based on four information levels.

Analysis indicates that the number of fighter aircraft actually launched as CAP aircraft had no effect on the number of Orange attack aircraft actually destroyed prior to the launch of weapons. Players that launched 24 CAP aircraft shot down the same number of Orange attackers as those that only launched eight CAP aircraft in some instances. The deciding factor in determining defensive results was how well the

aircraft were controlled after they were airborne, not just total numbers of aircraft. During this phase of the game the player was involved offensively in ensuring the strike packages encountered the minimum threat as well as maintaining a proper defensive posture. Those players with excessive CAP aircraft airborne were sometimes unable to maintain the tactical picture because of "information overload" and control of the airborne forces was adversely affected. The players had the forces required to accomplish the mission, but were unable to correctly make tactical decisions fast enough to counter the threat.

In summary, defensive capabilities did not seem to be affected by warfare community or information flow to the commander. The manner in which those forces were controlled once they were airborne could have been the primary reason for the results. In addition, since this simulation involved a man-in-the-loop, this could have been caused by variance between the players or other factors such as how the ROE were interpreted or the actual way the scenario was designed.

This type of experiment also identifies problems associated with the man-in-the-loop decision model for testing and experimental purposes. It does include a high degree of realism since human players are actually making the decisions; however, it also increases the cost and the duration of the simulation runs. In addition, the use of human players inserts

a high variance stochastic element into a simulation which might otherwise be deterministic. (Hartman, 1992, p16)

It is important to emphasize that this type of experiment does not provide a complete, all encompassing answer to a research question. If one were conducting tests of two systems to determine which performed better than the other, a simulation without the man-in-the-loop element should be used.

C. RECOMMENDATIONS

Continued research in this area is highly recommended to further analyze some of the questions raised by this experiment. The RESA simulation provides an excellent tool for researching various aspects of command and control issues. Other topics of possible interest are the "information overload " concept in a wargame as well as questions posed by the authors in the previous section.

VI. LESSONS LEARNED

A. EXPERIMENTAL DESIGN

The authors found the entire research effort to be extremely challenging in several respects. The man-in-the-loop type of simulation is difficult because one must solicit volunteer participation from a particular group of individuals who have the skills required for the experiment. The following list includes valuable lessons learned during the early phase of man-in-the-loop model development, when the actual design of the model was being developed. The authors provide the following guidelines:

1. Limit the number of factors for which the effects are being measured, as well as the different levels of those factors. In this experiment, the two factors examined were information flow (four levels) and warfare specialty (2 levels). This allowed only three samples of each particular configuration, which introduced excessive amounts of variation due to the small sample size. Larger cell counts are recommended if enough players are able to participate.

2. The procedure of having each participant play one scenario only one time prevented any learning curve effect. The authors did consider several options, such as having one player play one scenario at different levels of information, but decided against any plan that involved a learning curve effect. Having different versions of one scenario and having each player participate one time did prevent any learning curve effect; however, it did require more participants than any of the other methods.

3. Decide on measures of effectiveness early in the experimental development. This will help determine what type of data analysis will be conducted after the collection of

all data. Deciding on MOES early also prevents misdirected time and efforts in recording non-essential data.

B. DATA COLLECTION PHASE

The following list contains lessons learned during the actual simulation runs as well as early practice runs of the scenario.

1. Limit the scope of the simulation to achieve a reasonable maximum time required for completion of a single run.

2. Ensure all assistance from lab technicians is briefed in detail so all personnel understand exactly what their duties are so each run is conducted in exactly the same manner every time.

3. Be prepared for players to ask almost any type of question and for the players to use several different ways to perform a mission. All tactical possibilities must be considered in the planning phase of the scenario.

4. Player briefs must be well structured, organized, and most important of all, brief and concise.

5. Proper coordination with the Lab Manager is crucial for generating script files, scheduling lab time for the simulation runs, and ensuring that proper procedures were followed during the simulation.

APPENDIX A: SIMULATION PARTICIPANTS

1. LT Jeffrey Carlson, USN, SH-6B Pilot
2. LCDR Kevin Crawford, USN, F-14 NFO
3. LT Jack Davis, USN, Surface Warfare
4. CDR Robert Ellis, USN, P-3C NFO
5. LT Gary Formet, USN, F-14 NFO
6. LCDR Charles Fuller, USN, SH-60B Pilot
7. LT Jeff Gregoire, USN, A-6E NFO
8. LT Christopher Halton, USN, Surface Warfare
9. LT Thomas Halverson, USN, Surface Warfare
10. CDR Thomas Hoskins, USN, Surface Warfare
11. LT Donald Johnson, USN, SH-60B Pilot
12. LT Daniel Knaus, USN, E-2C NFO
13. LT Robert Laubengayer, USN, CH-46 Pilot
14. LT John Manser, USN, F-14 NFO
15. LT Michael McFerren, USN, E-2C NFO
16. LT Kurt Meisenheimer, USN, P-3C NFO
17. CDR Steven Meyers, USN, E-2C NFO
18. LT Charles Minter, USN, EA-6B NFO
19. LT Michael Moats, USN, E-2C NFO
20. LT David Rymer, USN, SH-60B Pilot
21. LCDR James Stewart, USN, P-3C NFO
22. LT Steven Tackett, USN, EA-6B NFO

23. CDR Stephen Walker, USN, F-14 NFO

24. LT Donald Zwick, USN, EA-6B NFO

Appendix B: Basic Experimental Results

Col1 War Spec	Col2 Level	Col3 Stk Pack	Col4 Sup Pack	Col5 EA6B Eff	Col6 Stk Lnch	Col7 Esc Lnch
1	0	2	1	1	16	12
0	0	1	1	1	24	8
0	1	1	0	1	20	14
1	1	3	0	0	28	10
0	0	2	2	0	12	20
0	2	1	2	1	24	22
1	0	2	1	0	16	4
1	2	1	1	1	28	8
1	2	2	0	0	18	24
0	2	1	1	1	34	8
1	3	2	0	0	28	13
1	1	2	0	1	24	8
1	0	2	0	0	24	16
1	1	2	1	0	26	8
0	3	1	2	1	12	12
1	3	2	0	1	22	14
0	1	2	0	1	32	0
1	2	2	0	1	28	8
0	3	2	2	1	24	16
1	3	1	2	1	28	10
0	2	1	2	1	8	4
0	0	2	1	1	24	8
0	3	2	2	0	16	16
0	1	2	0	0	16	16

LEGEND

War Spec: Warfare Specialty; TACAIR = 0, NON-TACAIR = 1

Level : Information Level; Very Low = 0, Low = 1, Medium = 2, High = 3

Stk Pack: Number of Strike Packages launched

Sup Pack: Number of Strike Support Packages launched

EA6B Eff: EA-6B effectiveness; Utilized = 1, Not Utilized = 0

Stk Lnch: Number of Strike aircraft launched

Esc Lnch: Number of Escort aircraft launched

EACH ROW IS DATA FROM ONE PLAYER / ONE MODEL RUN

Appendix B: Basic Experimental Results

Col8 SSup Int	Col9 SSup Ext	Col10 StkLostI	Col11 EscLostI	Col12 SSpLostI	Col13 StkLostE	Col14 EscLostE
2	4	3	3	1	5	7
0	7	0	2	1	7	6
5	0	0	0	0	10	14
4	0	16	6	2	1	0
0	10	3	7	7	4	4
2	6	1	0	0	0	5
4	9	12	2	12	4	0
2	3	0	1	0	4	6
6	0	3	11	0	4	0
1	6	0	0	0	11	8
2	0	10	7	2	8	2
4	0	4	2	1	1	1
4	0	3	12	2	3	1
4	8	7	0	9	7	7
0	6	1	2	0	11	9
4	0	2	0	0	7	4
1	0	1	0	1	14	0
5	0	1	1	1	11	4
0	6	1	1	0	10	7
2	4	7	1	0	15	7
0	10	0	0	9	0	3
2	10	3	7	2	6	0
1	6	5	14	4	7	1
2	0	8	9	1	3	2

LEGEND

SSup Int: Number of Strike Support aircraft launched that were internal to the Strike Package.

SSup Ext: Number of Strike Support aircraft launched that were external to the Strike Package.

StkLostI: Number of Strike aircraft lost during ingress.

EcsLostI: Number of Escort aircraft lost during ingress.

SSpLostI: Number of Strike Support aircraft lost during ingress.

StkLostE: Number of Strike aircraft lost during egress.

EscLostE: Number of Escort aircraft lost during egress.

EACH ROW IS DATA FROM ONE PLAYER / ONE MODEL RUN

Appendix B: Basic Experimental Results

Col15 SSpLostE	Col16 NKLnchI	Col17 NKLnchE	Col18 NKLostI	Col19 NKLostE	Col20 CAP Lnch	Col21 CSupLnch
1	33	0	8	2	8	5
1	0	33	0	5	16	9
3	0	33	0	0	14	8
1	42	0	40	0	14	14
0	42	0	17	3	10	9
4	0	15	0	9	8	10
0	72	0	16	0	10	11
5	0	38	0	15	20	9
0	24	0	18	6	14	11
7	0	33	0	8	10	9
0	18	0	0	5	12	3
0	23	0	12	7	12	12
2	47	0	32	1	8	4
3	24	0	3	0	20	8
6	0	33	0	0	20	8
2	0	33	0	1	12	10
0	0	33	0	14	12	5
2	0	33	0	6	20	9
2	0	33	0	4	8	10
2	5	18	0	8	16	10
0	5	42	2	17	14	7
5	38	0	8	13	14	8
1	38	0	10	0	17	10
0	33	0	9	5	24	12

LEGEND

SSpLostE: Number of Strike Support aircraft lost during egress.

NKLnchI : Number of Orange aircraft launched during Blue ingress.

NKLnchE : Number of Orange aircraft launched during Blue egress.

NKLostI : Number of Orange aircraft lost during Blue ingress.

NKLostE : Number of Orange aircraft lost during Blue egress.

CAP Lnch: Number of CAP aircraft launched.

CSupLnch: Number of CAP Support aircraft launched.

EACH ROW IS DATA FROM ONE PLAYER / ONE MODEL RUN

Appendix B: Basic Experimental Results

Col22 CAPLost	Col23 CSupLost	Col24 BadLost	Col25 AS5 Lnch	Col26 BEscLost	Col27 Ctc ID	Col28 BlueLnch
4	0	7	10	8	8	47
5	0	12	6	12	3	64
8	0	13	7	9	11	61
6	0	10	5	12	8	70
4	0	10	5	10	10	61
0	0	15	0	12	7	72
9	4	14	2	9	9	54
11	0	10	9	7	8	70
10	4	10	11	5	5	73
5	0	9	10	6	6	68
8	0	12	4	8	8	58
3	0	15	5	12	10	60
7	0	10	5	0	11	56
8	3	9	3	7	11	74
13	1	11	5	6	7	58
7	2	8	7	8	9	62
3	0	15	9	10	11	50
14	3	15	1	12	10	70
8	1	10	5	10	10	64
8	0	14	6	8	8	70
8	1	10	6	9	10	43
5	1	14	7	7	11	66
6	2	12	4	8	9	66
13	1	14	5	8	10	70

LEGEND

CAPLost : Number of CAP aircraft lost.

CSupLost: Number of CAP Support aircraft lost.

BadLost : Number of Orange Badger aircraft lost.

AS5 Lnch: Number of Orange Badger aircraft lost prior to reaching Weapon Release Point.

BEscLost: Number of Orange Badger Escort aircraft lost.

Ctc ID : Number of unknown contacts identified.

BlueLnch: Total number of Blue aircraft launched.

EACH ROW IS DATA FROM ONE PLAYER / ONE MODEL RUN

Appendix B: Basic Experimental Results

Col29 BlueLost	Col30 NKLnch	Col31 NKLost	Col32 Aircraft	Col33 SAM	Col34 Logistic	Col35 OP Comm
24	60	25	NA	NA	NA	NA
22	60	29	4	2	6	5
35	60	22	1	2	6	5
32	69	62	2	3	5	4
29	69	40	2	3	6	4
10	42	36	2	1	4	6
43	99	39	1	2	5	4
27	65	32	1	3	5	4
32	51	39	1	2	5	6
31	60	23	3	2	6	5
37	45	25	2	6	5	4
12	50	46	3	2	6	5
30	74	43	NA	NA	NA	NA
44	51	19	1	3	5	4
43	60	17	2	1	6	5
24	60	17	1	3	5	6
19	60	39	3	1	6	5
37	60	33	3	4	5	6
30	60	24	3	2	6	5
40	50	30	4	1	6	5
21	74	38	3	4	6	5
29	65	42	2	1	5	6
40	65	30	2	3	5	6
37	60	36	2	1	4	5

LEGEND

BlueLost: Total number of Blue aircraft lost.

NKLnch : Total number of Orange aircraft launched.

NKLost : Total number of Orange aircraft lost.

Aircraft: Player ranking of aircraft data importance.

SAM : Player ranking of SAM data importance.

Logistic: Player ranking of logistic data importance.

OP Comm : Player ranking of operation communication data importance.

EACH ROW IS DATA FROM ONE PLAYER / ONE MODEL RUN

Appendix B: Basic Experimental Results

Col36 Air Surv	Col37 Def Stgy	Col38 NTA a/c	Col39 TA a/c	Col40 NTA SAM	Col41 TA SAM	Col42 NTA LOG
NA	NA	NA	4	NA	2	NA
3	1	2	1	3	2	5
3	4	1	2	2	3	5
1	6	1	2	3	1	5
1	5	1	3	2	2	5
3	5	2	2	6	1	5
3	6	3	3	2	1	6
2	6	NA	3	NA	2	NA
3	4	1	3	3	4	5
1	4	1	2	3	1	5
1	3	3	2	4	3	5
4	1	4	2	1	1	6
NA	NA					
2	6					
3	4					
2	4					
2	4					
1	2					
1	4					
2	3					
1	2					
4	3					
1	4					
3	6					

```
LEGEND

Air Surv: Player ranking of radar data importance.

Def Stgy: Player ranking of Orange defensive strategy data importance.

NTA a/c : NON-TACAIR player ranking of aircraft data importance.

TA a/c  : TACAIR player ranking of aircraft data importance.

NTA SAM : NON-TACAIR player ranking of SAM data importance.

TA SAM  : TACAIR player ranking of SAM data importance.

NTA LOG : NON-TACAIR player ranking of logistic data importance.

EACH ROW IS DATA FROM ONE PLAYER / ONE MODEL RUN
```

Appendix B: Basic Experimental Results

Col43 TA LOG	Col44 NTA COMM	Col45 TA COMM	Col46 NTA Surv	Col47 TA Surv	Col48 NTA Stgy	Col49 TA Stgy
6	NA	5	NA	3	NA	1
6	4	5	1	3	6	4
6	4	4	3	1	6	5
4	4	6	2	3	6	5
6	6	5	3	1	4	4
6	4	5	1	3	3	4
6	5	5	4	2	1	4
6	NA	5	NA	1	NA	4
6	4	5	2	1	6	2
5	6	6	2	4	4	3
5	6	6	1	1	2	4
4	5	5	2	3	3	6

LEGEND

TA LOG : TACAIR player ranking of logistic data importance.

NTA COMM: NON-TACAIR player ranking of operational communication data importance.

TA COMM : TACAIR player ranking of operational communication data importance.

NTA Surv: NON-TACAIR player ranking of radar data importance.

TA Surv : TACAIR player ranking of radar data importance.

NTA Stgy: NON-TACAIR player ranking of Orange defensive strategy data importance.

TA Stgy : TACAIR player ranking of Orange defensive strategy data importance.

EACH ROW IS DATA FROM ONE PLAYER / ONE MODEL RUN

Appendix C: Analysis Data

Col1 War Spec	Col2 Level	Col3 Stk Pack	Col4 Stk TGT	Col5 %Stk TGT	Col6 CAP Lnch	Col7 BAD Lost	Col8 Ctc ID
1	0	2	13	0.8125	8	10	8
0	0	1	24	1	16	6	3
0	1	1	20	1	14	7	11
1	1	3	12	0.428571	14	5	8
0	0	2	9	0.75	10	5	10
0	2	1	23	0.958333	8	0	7
1	0	2	4	0.25	10	2	9
1	2	1	28	1	20	9	8
1	2	2	15	0.833333	14	11	5
0	2	1	34	1	10	10	6
1	3	2	18	0.642857	12	4	8
1	1	2	20	0.833333	12	5	10
1	0	2	21	0.875	8	5	11
1	1	2	19	0.730769	20	3	11
0	3	1	11	0.916667	20	5	7
1	3	2	20	0.909091	12	7	9
0	1	2	31	0.96875	12	9	11
1	2	2	27	0.964286	20	1	10
0	3	2	23	0.958333	8	5	10
1	3	1	21	0.75	16	6	8
0	2	1	8	1	14	6	10
0	0	2	21	0.875	14	7	11
0	3	2	11	0.6875	17	4	9
0	1	2	8	0.5	24	5	10

LEGEND

War Spec: Warfare Specialty; TACAIR = 0, NON-TACAIR = 1.
Level : Information Level; Very Low = 0, Low = 1, Medium = 2,
High = 3.
Stk Pack: Number of Strike Packages launched.
Stk TGT : Number of Strike aircraft reaching target.
%Stk TGT: Percentage of Strike aircraft reaching target.
CAP Lnch: Number of CAP aircraft launched.
BAD Lost: Number of Orange Badger aircraft lost prior to launching weapons.
Ctc ID : Number of unknown contacts identified.
EACH ROW IS DATA FROM ONE PLAYER / ONE MODEL RUN

Appendix C: Analysis Data

Col1 War Spec	Col2 Level	Col3 Stk Pack	Col4 Stk TGT	Col5 %Stk TGT	Col6 CAP Lnch	Col7 BAD Lost	Col8 Ctc ID
0	0	1	24	1	16	6	3
0	1	1	20	1	14	7	11
0	0	2	9	0.75	10	5	10
0	2	1	23	0.958333	8	0	7
0	2	1	34	1	10	10	6
0	3	1	11	0.916667	20	5	7
0	1	2	31	0.96875	12	9	11
0	3	2	23	0.958333	8	5	10
0	2	1	8	1	14	6	10
0	0	2	21	0.875	14	7	11
0	3	2	11	0.6875	17	4	9
0	1	2	8	0.5	24	5	10

LEGEND

War Spec: Warfare Specialty; TACAIR.
Level : Information Level; Very Low = 0, Low = 1, Medium = 2, High = 3.
Stk Pack: Number of Strike Packages launched.
Stk TGT : Number of Strike aircraft reaching target.
%Stk TGT: Percentage of Strike aircraft reaching target.
CAP Lnch: Number of CAP aircraft launched.
BAD Lost: Number of Orange Badger aircraft lost prior to launching weapons.
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Appendix C: Analysis Data

Col1 War Spec	Col2 Level	Col3 Stk Pack	Col4 Stk TGT	Col5 %Stk TGT	Col6 CAP Lnch	Col7 BAD Lost	Col8 Ctc ID
1	0	2	13	0.8125	8	10	8
1	1	3	12	0.428571	14	5	8
1	0	2	4	0.25	10	2	9
1	2	1	28	1	20	9	8
1	2	2	15	0.833333	14	11	5
1	3	2	18	0.642857	12	4	8
1	1	2	20	0.833333	12	5	10
1	0	2	21	0.875	8	5	11
1	1	2	19	0.730769	20	3	11
1	3	2	20	0.909091	12	7	9
1	2	2	27	0.964286	20	1	10
1	3	1	21	0.75	16	6	8

```
LEGEND

War Spec: Warfare Specialty; NON-TACAIR.
Level   : Information Level; Very Low = 0, Low = 1, Medium = 2, High = 3.
Stk Pack: Number of Strike Packages launched.
Stk TGT : Number of Strike aircraft reaching target.
%Stk TGT: Percentage of Strike aircraft reaching target.
CAP Lnch: Number of CAP aircraft launched.
BAD Lost: Number of Orange Badger aircraft lost prior to launching weapons.
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EACH ROW IS DATA FROM ONE PLAYER / ONE MODEL RUN
```

Appendix C: Analysis Data

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0		0	1	24	1	16	6		3
0		0	1	20	1	14	7		11
1		0	3	12	0.428571	14	5		8
0		0	2	9	0.75	10	5		10
0		1	1	23	0.958333	8	0		7
1		0	2	4	0.25	10	2		9
1		1	1	28	1	20	9		8
1		1	2	15	0.833333	14	11		5
0		1	1	34	1	10	10		6
1		1	2	18	0.642857	12	4		8
1		0	2	20	0.833333	12	5		10
1		0	2	21	0.875	8	5		11
1		0	2	19	0.730769	20	3		11
0		1	1	11	0.916667	20	5		7
1		1	2	20	0.909091	12	7		9
0		0	2	31	0.96875	12	9		11
1		1	2	27	0.964286	20	1		10
0		1	2	23	0.958333	8	5		10
1		1	1	21	0.75	16	6		8
0		1	1	8	1	14	6		10
0		0	2	21	0.875	14	7		11
0		1	2	11	0.6875	17	4		9
0		0	2	8	0.5	24	5		10

LEGEND

War Spec: Warfare Specialty; TACAIR = 0, NON-TACAIR = 1.
Level : Information Level; Low = 0, High = 1.
Stk Pack: Number of Strike Packages launched.
Stk TGT : Number of Strike aircraft reaching target.
%Stk TGT: Percentage of Strike aircraft reaching target.
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Appendix C: Analysis Data

Col1 War Spec	Col2 Level	Col3 Stk Pack	Col4 Stk TGT	Col5 %Stk TGT	Col6 CAP Lnch	Col7 BAD Lost	Col8 Ctc ID
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0	0	1	20	1	14	7	11
0	0	2	9	0.75	10	5	10
0	1	1	23	0.958333	8	0	7
0	1	1	34	1	10	10	6
0	1	1	11	0.916667	20	5	7
0	0	2	31	0.96875	12	9	11
0	1	2	23	0.958333	8	5	10
0	1	1	8	1	14	6	10
0	0	2	21	0.875	14	7	11
0	1	2	11	0.6875	17	4	9
0	0	2	8	0.5	24	5	10

LEGEND

War Spec: Warfare Specialty; TACAIR.
Level : Information Level; Low = 0, High = 1.
Stk Pack: Number of Strike Packages launched.
Stk TGT : Number of Strike aircraft reaching target.
%Stk TGT: Percentage of Strike aircraft reaching target.
CAP Lnch: Number of CAP aircraft launched.
BAD Lost: Number of Orange Badger aircraft lost prior to launching weapons.
Ctc ID : Number of unknown contacts identified.
EACH ROW IS DATA FROM ONE PLAYER / ONE MODEL RUN

Appendix C: Analysis Data

Col1 War Spec	Col2 Level	Col3 Stk Pack	Col4 Stk TGT	Col5 %Stk TGT	Col6 CAP Lnch	Col7 BAD Lost	Col8 Ctc ID
1	0	2	13	0.8125	8	10	8
1	0	3	12	0.428571	14	5	8
1	0	2	4	0.25	10	2	9
1	1	1	28	1	20	9	8
1	1	2	15	0.833333	14	11	5
1	1	2	18	0.642857	12	4	8
1	0	2	20	0.833333	12	5	10
1	0	2	21	0.875	8	5	11
1	0	2	19	0.730769	20	3	11
1	1	2	20	0.909091	12	7	9
1	1	2	27	0.964286	20	1	10
1	1	1	21	0.75	16	6	8

```
LEGEND

War Spec: Warfare Specialty; NON-TACAIR.
Level   : Information Level; Low = 0, High = 1.
Stk Pack: Number of Strike Packages launched.
Stk TGT : Number of Strike aircraft reaching target.
%Stk TGT: Percentage of Strike aircraft reaching target.
CAP Lnch: Number of CAP aircraft launched.
BAD Lost: Number of Orange Badger aircraft lost prior to launching weapons.
Ctc ID  : Number of unknown contacts identified.
EACH ROW IS DATA FROM ONE PLAYER / ONE MODEL RUN
```

APPENDIX D: PLAYER DISTRIBUTION

Information Level by Warfare Specialty	Very Low	Low	Medium	High
TACAIR	LCDR Crawford LT Moats CDR Walker	LT Knaus LT Mansor LT Zwick	LT Gregoire LT McFerren LT Tackett	LT Formet LCDR Meyers LT Minter
ASW TACAIR	LT Davis CDR Ellis LT Labengayer	LT Halton LT Johnson LT Rymer	LT Fuller LT Meisenheimer LCDR Stewart	LT Carlson LT Halvorson CDR Hoskins

APPENDIX E: INTELLIGENCE BRIEFS

A. INITIAL INTELLIGENCE BRIEF (ALL PLAYERS)

1. Background

a. Navy

The North Korean Navy is largely a coastal defense force consisting mostly of small patrol craft, missile attack boats, corvettes, amphibious craft and mine warfare units. Although these units do not possess a sustained blue water operational capability, some units have been observed operating a significant distance from the coast for limited amounts of time during increased tensions and crises. These platforms do not pose a serious threat to an aircraft carrier battlegroup; however, vigilance is recommended.

The Naval organization is comprised of two fleets; East and West. The East Coast Fleet has its headquarters at Toejo Dong with major bases at Najin and Wonson. The West Coast Fleet is headquartered at Nampo with major bases at Pipa Got and Sagon Ni. Minor bases are established in various locations along both coasts.

The Navy's most capable surface threat to a carrier battlegroup is the guided-missile patrol boats; these are versions of the Soviet designed OSA-1 units. They are estimated to have 25 of these small patrol craft. All are

equipped with the STYX missile launchers and carry the SS-N-2A anti-ship missile. These smaller craft usually remain within 50 NM of the North Korean coastline to police territorial waters but have been observed to travel out further into the Sea of Japan for certain exercises.

b. Air Force

The North Korean Air Force's primary mission is defense of the homeland. This is accomplished by an intricate air defense network of fighters, surface-to-air missile (SAM) sites and anti-aircraft artillery sites. Their combat aircraft inventory consists of approximately 250 aircraft of the following types: Mig-19, MiG-21, Mig-23 and MiG-29. Additionally, they possess the capability to perform long range tactical air strikes with their newly acquired Badger aircraft from the former Soviet Union. They are estimated to have obtained 20 to 30 of these aircraft.

c. Air Defense

The North Korean's approach to air defense reflects their experiences during the Korean war; consequently, much effort has been taken to repel or at least reduce the damage inflicted to its industry and military installations due to attacks by enemy air forces. As a result, air defense is a top priority. The air defense network employs a combination of antiaircraft guns with SA-2, SA-3, SA-5 and SA-7 surface-to-air missiles to provide an extremely dense air defense network.

B. VERY LOW LEVEL INITIAL INTELLIGENCE BRIEF

1. Defensive Strategy

Little is known about the North Korean command and control structure; however, it is known that they divide the country into various sectors of responsibility with a control base being accountable for coordinating the use of SAM sites and fighter aircraft to engage attacking aircraft. Each of the below discussed air bases is a control center and will execute the defensive strategy whenever a strike penetrates their area of coverage. MiG-19 and MiG-21 aircraft are not very capable and are only a serious threat if they are in very close proximity to a potential target. Fortunately, their short range weapons and short combat radius limit their ability to pursue attacking aircraft; therefore, these aircraft can easily be outrun and outmaneuvered. The MiG-23 and MiG-29 aircraft are far more capable. They have longer range missiles, a longer combat radius and greater speed; therefore, they can be expected to aggressively pursue attacking aircraft.

2. Intelligence Summary Very Low

a. Chongjin

- 13 aircraft counted at field outside hangars. 2 structures at field that appear to be hangers.
- SAM radar emissions; type and quantities unknown.
- Air-search radars present; operating parameters and range unknown.

- Increased message traffic between Chongjin and Hamhung.
- Increased logistic support vehicle traffic; contents unknown.

b. Songjin

- 22 aircraft counted at field outside hangars.
- 4 hangars located at field.
- SAM radar emissions; type and quantity unknown.
- Air-search radars present; operating parameters and range unknown.
- Routine message traffic between Songjin and Pyongyang.
- High amount of message traffic between Songjin and unidentified locations.
- Routine logistic support vehicle traffic.

c. Hamhung

- 15 aircraft counted at field outside hangers.
- 5 primary structures at field, type unknown. SAM radar emissions - type and quantity unknown.
- Air-search radars present; operating parameters and range unknown.
- Increased message traffic between Hamhung, Chongjin, Wonson and Pyongyang.
- Routine logistic support vehicle traffic.

d. Wonson

- 9 aircraft counted at field outside hangars.
- SAM radar status unknown; last SAM emissions detected 10 days ago. SAM facilities possibly down.

- Air-search radars present; operating parameters and range unknown.
- Increased message traffic between Wonson and Hamhung; appears to be operational in nature.
- Increased logistic support vehicle traffic; contents unknown.

e. Pyongyang * Capital City *

- 46 aircraft counted at field outside hangars.
- Numerous large structures at field, type unknown.
- Numerous SAM facilities and emissions; type and quantity unknown.
- Numerous air-search radars present; operating parameters and range unknown.
- Increased message traffic between Pyongyang, Chongjin, Hamhung, Wonson and Kanggye.
- Routine logistic support vehicle traffic.

f. Sinuiju

- 25 aircraft counted at field outside hangars.
- 7 large structures at field, type unknown.
- SAM radar emissions present, type and quantity unknown.
- Air-search radar present, operating parameters and range unknown.
- Increased message traffic between Sinuiju and Kanggye.
- Routine logistics support vehicle traffic.

g. Kanggye (TARGET)

- No recent information as of this date. Most likely have sophisticated air defense capability.

h. **Remote SAM/AAA Sites**

Numerous remote SAM/AAA sites are deployed throughout the country to help defend against attack. Usually they are deployed in defense of major cities, military bases and supply routes. Most sites are along the coast; however, some are located inland.

C. LOW LEVEL INITIAL INTELLIGENCE BRIEF

1. Defensive Strategy

The North Koreans utilize a coordinated scheme that combines SAM sites and fighter aircraft to counter air threats. The strategy consists of dividing the country into various sectors of responsibility with a control base being accountable for coordinating the use of SAM sites and fighter aircraft to engage attacking aircraft. MiG-19 and MiG-21 aircraft are not very capable and are only a serious threat if they are in very close proximity to a potential target. Fortunately, their short range weapons and short combat radius limit their ability to pursue attacking aircraft; therefore, these aircraft can easily be outrun and outmaneuvered. The MiG-23 and MiG-29 aircraft are far more capable. They have longer range missiles, a longer combat radius and greater speed; therefore, they can be expected to aggressively pursue attacking aircraft. Each of the below discussed air bases is a control center and will execute the defensive strategy whenever a strike penetrates their area of coverage. Incoming strikes are detected by air-search radars, ground units and

naval assets and are relayed to the nearest control center where that base will activate its SAM sites and scramble fighter aircraft. Estimates vary but it is expected that the base will scramble a moderate number of aircraft to intercept the enemy strike package.

2. Intelligence Summary Low

a. Chongjin

- 13 aircraft counted outside hangar facilities; 4 Bombers, 9 Fighters.
- 2 structures at field. 1 hanger and 1 weapons storage facility.
- SA-2 and SA-3 SAM radar emissions; multiple sites, quantity of each site is unknown.
- Air-search radars in continuous operation, operating parameters unknown, range estimated from 30-70 nm.
- Increased message traffic between Hamhung and Chongjin. Contents include aircraft readiness and updates about US CV battlegroup composition.
- Higher than normal amount of air-ground transmissions.
- Increased logistic support vehicle traffic. Contents believed to be weapons, type ordnance unknown.

b. Songjin

- 22 fighter aircraft counted outside hangar facilities.
- 4 hangars located at field.
- SA-2 and SA-3 SAM radar emissions, multiple sites most of which are not at airfield and appear to be at random distances from Songjin.
- Air-search radars in continuous operation, operating parameters unknown, range estimated from 30-70 nm.

- Routine message traffic between Songjin and Pyongyang.
- High amount of message traffic between Songjin and unidentified locations. Contents include readiness reports and ordnance status.
- Routine logistic support vehicle traffic.
- Normal to slightly below normal amount of air-ground transmissions.

c. Hamhung

- 15 fighter aircraft counted outside hangers.
- 3 hangars, 1 weapons storage facility and 1 communications facility.
- SA-2 and SA-3 SAM radar emissions; multiple sites, quantity of each site is unknown.
- Air-search radars in continuous operation, operating parameters unknown, range estimated from 30-70 nm.
- Increased message traffic between Hamhung, Chongjin, Wonson and Pyongyang. Contents include aircraft readiness, logistics support and updates about US CV battle group composition.
- Routine logistic support vehicle traffic.

d. Wonson

- 9 Bomber aircraft counted at field outside hangars.
- 4 hangars and 1 weapons storage facility.
- SA-2 radar sites are up and SA-3 site is not operational, anticipate site operational soon.
- Air-search radars present; operating parameters unknown and range estimated from 30-70 nm.
- Increased message traffic between Wonson and Hamhung; contents include logistic information, aircraft readiness reports and pilot efficiency reports.

- Increased logistic support vehicle traffic; contents include radar parts and ordnance.

e. Pyongyang * Capital City *

- 46 aircraft counted at field outside hangars; 3 Bombers and 43 Fighters.
- 10 hangars, 2 communications facility, 3 weapons storage depots, and numerous hardened bunkers. This is the hub of all command and control activities for the country.
- Multiple SA-2, SA-3 and SA-5 SAM sites; quantities unknown and exact locations undetermined.
- Multiple air-search radars present; operating parameters and ranges from between 30-70 nm.
- Increased message traffic between Pyongyang, Chongjin, Hamhung, Wonson and Kanggye. Contents include aircraft readiness data, pilot efficiency reports and logistics data.
- Routine logistic support vehicle traffic to Songjin, Hamhung and Sinuiju, and increased logistic support to Chongjin and Wonson.

f. Sinuiju

- 25 Fighter aircraft counted at field outside hangars.
- 6 hangars and 1 training facility.
- SA-2 SAM radar emissions present, quantity and exact locations unknown.
- Air-search radar present, operating parameters unknown and ranges from between 30-70 nm.
- Increased message traffic between Sinuiju and Kanggye. Contents include flight sortie data and SAM/AAA location inquiries.
- Routine logistics support vehicle traffic.

g. Kanggye (TARGET)

- Multiple SAM and AAA sites are operational, exact types, quantities and locations are unknown.
- Increased message traffic between Kanggye and Sinuiju. Contents include flight sortie data and SAM/AAA location inquiries.

h. Remote SAM/AAA Sites

Numerous remote SAM/AAA sites are deployed throughout the country to help defend against attack. Most sites are located to the north and south of all bases except Sinuiju. A few sites are located inland. Exact numbers of sites and locations

are unknown; however, they are believed to be composed of SA-2, SA-3 and ZSU-23 components. Some sites may also have SA-5 launchers.

D. MEDIUM LEVEL INITIAL INTELLIGENCE BRIEF

1. Defensive Strategy

The North Koreans utilize a coordinated scheme that combines SAM sites and fighter aircraft to counter air threats. The strategy consists of dividing the country into various sectors of responsibility with a control base being accountable for coordinating the use of SAM sites and fighter aircraft to engage attacking aircraft. MiG-19 and MiG-21 aircraft are not very capable and are only a serious threat if they are in very close proximity to a potential target. Fortunately, their short range weapons and short combat radius

limit their ability to pursue attacking aircraft; therefore, these aircraft can easily be outrun and outmaneuvered. The MiG-23 and MiG-29 aircraft are far more capable. They have longer range missiles, a longer combat radius and greater speed; therefore, they can be expected to aggressively pursue attacking aircraft. Each of the below discussed air bases is a control center and will execute the defensive strategy whenever a strike penetrates within 50 nm of the base. Intelligence estimates that the Chongjin defensive perimeter is 30 nm. Incoming strikes are detected by air-search radars, ground units and naval assets and are relayed to the control center where that base will activate its SAM sites and scramble fighter aircraft. Utilization of the EA-6B should reduce the detection capabilities of the search radars as well as reduce the SAM threat. Estimates vary but it is expected that the base will scramble a moderate number of aircraft to intercept the enemy strike package. It is not known whether additional aircraft will scramble from other bases or to what degree SAM sites not inside of the controlling center's area of responsibility will become active.

2. **Intelligence Summary Medium**

a. **Chongjin**

- 13 aircraft counted outside hangar facilities; 4 Badgers, 7 MiG-23 and 2 MiG-29 aircraft.
- 1 hanger contains 6 additional aircraft; type unknown.

- Ordnance transfers between weapons storage facility and hangars has increased significantly.

- Estimate two SA-2 and two SA-3 SAM radar sites, suspected location in vicinity of airfield.

- Air-search radars in continuous operation, operating intermittently, detection range estimated from 0-30 nm.

- Increased message traffic between Hamhung and Chongjin. Contents include Badger aircraft readiness, air traffic routes, references to "Plan A and Plan B", and updates about US CV battlegroup composition.

- Higher than normal amount of air-ground and air-air transmissions.

- Increased logistic support vehicle traffic. Contents believed to be air-air and air-surface weapons.

b. Songjin

- 22 fighter aircraft counted outside hangar facilities; 10 Mig-23, 5 MiG-21 and 7 MiG-29 aircraft.

- 4 hangars located at field contain an additional 13 aircraft, type unknown.

- SA-2 and SA-3 SAM radar emissions, Two SA-3 sites within vicinity of airfield. One SA-2 site within 60 nm north of Songjin, one SA-2 site within 60 nm south and two SA-2 sites within 60 nm west of Songjin, exact locations unknown.

- Air-search radars in continuous operation, operating parameters unknown, detection range estimated from 0-50 nm.

- Routine message traffic between Songjin and Pyongyang.

- High amount of message traffic between Songjin and unlocated SAM sites. Contents include readiness reports, ordnance status, and increased alert status.

- Normal to slightly below normal amount of air-ground transmissions and routine air-to-air transmissions.

- Routine logistic support vehicle traffic.

c. Hamhung

- 15 fighter aircraft counted outside hanger facilities; 6 Mig-23, 5 MiG-21 and 4 MiG-19 aircraft.
- 3 hangars with an additional 10 aircraft (total) inside these facilities. 1 weapons storage facility and 1 communications/aircraft control facility.
- SA-2 and SA-3 SAM radar emissions; multiple sites within vicinity of airfield.
- Air-search radars in continuous operation, operating parameters unknown, detection range estimated from 0-50 nm.
- Increased message traffic between Hamhung, Chongjin, Wonson and Pyongyang. Contents include aircraft readiness, rendezvous data, Plan A and Plan B composition requirements, as well as updates about US CV battle group composition and position.
- Routine logistic support vehicle traffic.

d. Wonson

- 9 Badger aircraft counted at field outside hangars.
- 4 hangars that contain an additional 20 aircraft total. 1 weapons storage facility.
- Three SA-2 radar sites located in vicinity of field are up and SA-3 in vicinity of field is not operational and not expected to be in near future.
- Air-search radars in continuous operation, operating parameters unknown, detection range estimated from 0-50 nm.
- Increased message traffic between Wonson and Hamhung; contents include fighter rendezvous data, Plan A and Plan B aircraft coordination schemes, logistic information, aircraft readiness reports and pilot efficiency reports.
- Increased logistic support vehicle traffic; contents include radar parts and ordnance as well as air-air and air-surface weapons.

e. Pyongyang * Capital City *

- 46 aircraft counted at field outside hangars; 3 Badgers, 6 MiG-29, 14 MiG-23, 16 Mig-21 and 7 MiG-21 aircraft.
- 10 hangars with an additional 20 aircraft total. 2 communications/aircraft control facilities, 3 weapons storage depots, and numerous hardened command bunkers. This is the hub of all command and control activities for the country.
- Multiple SA-2, SA-3 and SA-5 SAM sites within airfield vicinity and surrounding the city.
- Multiple air-search radars present in continuous operation, detection range estimated from 0-50 nm.
- Increased message traffic between Pyongyang, Chongjin, Hamhung, Wonson and Kanggye. Contents include aircraft readiness data, pilot efficiency reports, Plan A and Plan B compositions, rendezvous positions, communication plans and logistics data.
- Routine logistic support vehicle traffic to Songjin, Hamhung and Sinuiju, and increased ordnance logistic support to Chongjin and Wonson.

f. Sinuiju

- 25 MiG-21 aircraft counted at field outside hangars.
- 6 hangars with an additional 7 aircraft total in the facilities and 1 training facility utilized for flight training.
- Three SA-2 SAM sites presently located in vicinity of the airfield.
- Air-search radars in continuous operation, operating parameters unknown, detection range estimated from 0-50 nm.
- Increased message traffic between Sinuiju and Kanggye. Contents include flight sortie data, SAM/AAA location inquiries and operational status reports, and aircraft support updates.
- Routine logistics support vehicle traffic.

g. Kanggye (TARGET)

- Three SA-2 and two SA-3 SAM sites, as well as two ZSU-23 AAA sites are operational, exact locations are unknown but are in close proximity to weapon research facility.
- Increased message traffic between Kanggye and Sinuiju. Contents include SAM/AAA location and status reports, aircraft support requirements and communications reliability reports.

h. Remote SAM/AAA Sites

Numerous remote SAM/AAA sites are deployed throughout the country to help defend against attack. Most sites are located to the north and south of all bases except Sinuiju and form a formidable barrier against air attacks from the sea. A few sites are located inland along suspected aircraft ingress/egress routes in the vicinity of Songjin. Songjin is a major base, and it has a larger number of SAM sites in its control area due to its central position along the coast. Exact numbers of sites and locations are unknown; however, they are believed to be deployed near coastal cities and around airbases. These sites are composed of SA-2, SA-3 and ZSU-23 components.

E. HIGH LEVEL INITIAL INTELLIGENCE BRIEF

1. Defensive Strategy

The North Koreans utilize a coordinated scheme that combines SAM sites and fighter aircraft to counter air threats. The strategy consists of dividing the country into various sectors of responsibility with a control base being

accountable for coordinating the use of SAM sites and fighter aircraft to engage attacking aircraft. MiG-19 and MiG-21 aircraft are not very capable and are only a serious threat if they are in very close proximity to a potential target. Fortunately, their short range weapons and short combat radius limit their ability to pursue attacking aircraft; therefore, these aircraft can easily be outrun and outmaneuvered. The MiG-23 and MiG-29 aircraft are far more capable. They have longer range missiles, a longer combat radius and greater speed; therefore, they can be expected to aggressively pursue attacking aircraft. Each of the below discussed air bases is a control center and will execute the defensive strategy whenever a strike penetrates within 50 nm of the base. Intelligence estimates that the Chongjin defensive perimeter is 30 nm. Incoming strikes are detected by air-search radars, ground units and naval assets and are relayed to the control center where that base will activate its SAM sites and scramble 1/2 the bases total number of fighter aircraft to intercept the enemy strike package. Utilization of the EA-6B should reduce the detection capabilities of the search radars as well as SAM effectiveness: however, once detected, the number of aircraft scrambled will be as stated above. The other control centers (those not penetrated) will not become active and not scramble aircraft until their defensive perimeter has been penetrated; however, the entire country's SAM network will become active.

2. Intelligence Summary High

a. Chongjin

- 5 Badgers, 4 MiG-29 and 10 MiG-23 aircraft.
- Ordnance supply contains AS-5 Kitchen, AA-10 and AA-7 missiles.
- Two SA-2 and two SA-3 SAM radar sites located at airfield.
- Air-search radars in continuous operation, detection ranges from 0-30 nm.
- Message traffic between Hamhung and Chongjin. Contents include: Fighter patrol vector information to CV CAP aircraft positions, fighter and bomber flight routes, and updates about US CV battlegroup composition and location.
- Higher than normal amount of air-ground and air-air transmissions.
- Increased logistic support vehicle traffic. Contents are air-air and air-surface weapons.

b. Songjin

- 15 MiG-23, 10 MiG-29 and 10 MiG-21 aircraft.
- Ordnance supply contains AA-7 and AA-2 missiles.
- Two SA-3 SAM radar sites located at airfield and one SA-2 SAM site located at each of the following remote locations: Kilju, Tanchon, Kapsan and Pungsan.
- Air-search radars in continuous operation, detection ranges from 0-50 nm.
- Routine message traffic between Songjin and Pyongyang.
- High amount of message traffic between Songjin and remote SAM sites. Contents include readiness reports, ordnance status, and increased alert status.
- Normal to slightly above normal amount of air-ground transmissions and routine air-to-air transmissions.
- Routine logistic support vehicle traffic.

c. Hamhung

- 10 MiG-19, 10 MiG-23 and 10 MiG-21 aircraft.
- Ordnance supply contains AA-7, AA-2 and Sidewinder missiles.
- Tactical Air combat/Strike Operations Center. This facility handles coordination of all air defense and strike assets for the east coast.
- Two SA-2 and two SA-3 SAM radar sites located at airfield.
- Air-search radars in continuous operation, detection ranges from 0-50 nm.
- Increased message traffic between Hamhung, Chongjin, Wonson and Pyongyang. Contents include: coordinated fighter patrol vector information to CV CAP aircraft positions, fighter and bomber rendezvous/flight routes, and updates about U.S. CV battlegroup composition and location.
- Routine logistic support vehicle traffic.

d. Wonson

- 10 Badgers, 10 MiG-29 and 15 MiG-23 aircraft.
- Ordnance supply contains AS-5 Kitchen, AA-10 and AA-7 missiles.
- Three SA-2 and one SA-3 SAM radar sites located at airfield; only the SA-2 sites are operational.
- Air-search radars in continuous operation, detection ranges from 0-50 nm.
- Increased message traffic between Wonson and Hamhung; Contents include: coordinated fighter patrol vector information to CV CAP aircraft positions, fighter and bomber rendezvous/flight routes, and updates about US CV battlegroup composition and location.
- Increased logistic support vehicle traffic; contents include radar parts and ordnance as well as air-air and air-surface weapons.

e. Pyongyang * Capital City *

- 10 Badgers, 10 MiG-29, 20 MiG-23, 20 MiG-21 and 10 MiG-19 aircraft.
- Ordnance supply contains AS-5 Kitchen, AA-10, AA-7, AA-2, AA-8 and Sidewinder missiles.
- Numerous command, control communications facilities. This is the hub of all command and control activities for the country.
- Four of the following SAM sites located at the airfield and surrounding the city; SA-2, SA-3 and SA-5.
- Air-search radars in continuous operation, detection ranges from 0-50 nm.
- Increased message traffic between Pyongyang, Chongjin, Hamhung, Wonson and Kanggye. Contents include: political updates, ROE, defense and strike plans, and updates about US CV battlegroup composition and location.
- Routine logistic support vehicle traffic to Songjin, Hamhung and Sinuiju, and increased ordnance logistic support to Chongjin and Wonson.

f. Sinuiju

- 40 MiG-21 aircraft.
- Ordnance supply contains AA-2 and AA-8 missiles.
- Three SA-2 SAM sites located at the airfield.
- Air-search radars in continuous operation, detection ranges from 0-50 nm.
- Increased message traffic between Sinuiju and Kanggye. Contents include air defense posture for protecting weapons research facility.
- Routine logistics support vehicle traffic.

g. **Kanggye (TARGET)**

- Three SA-2 and two SA-3 SAM sites, as well as two ZSU-23 AAA sites are operational and are in close proximity to weapons research facility.
- Increased message traffic between Kanggye and Sinuiju. Contents include air defense requests for protecting weapons research facility.

h. **Remote SAM/AAA Sites**

Numerous remote SAM/AAA sites are deployed throughout the country to help defend against attack. T[illegible] sites are located near various coastal cities and bases and are spread from the Chinese border and extend down to the border with the ROK. Some inland sites are deployed and are controlled by the base at Songjin. These stations are located at the sites listed in the intelligence summary for Songjin. These sites are composed of SA-2, SA-3, SA-7 and ZSU-23 components. See briefing map for exact locations.

F. FORCE AND WEAPONS SUMMARY

1. US Forces and Weapons

a. **Nimitz Battle Group located approximately 270 nm east of Wonson. Battlegroup composition as follows:**

(1) USS Nimitz - Nimitz Class (CVN-68)/ Sea Sparrow
(2) USS Bunker Hill - Aegis Class (CG-47)/ SM-2 MR
(3) USS Jouett - Belknap Class (CG-26)/ SM-2 ER
(4) USS Caron - Spruance Class (DD-963)/ Sea Sparrow
(5) USS Scott - Kidd Class (DDG-993)/ SM-1 MR
(6) USS Clark - Perry Class (FFG-7)/ SM-1 MR
(7) USS Boone - Perry Class (FFG-7)/ SM-1 MR
(8) USS Stump - Spruance Class (DD-963)/ Sea Sparrow

b. Surface-to-Air Weapons

(1) SM-2 ER / 90 NM Max Range
(2) SM-2 MR / 50 NM Max Range
(3) SM-1 MR / 25 NM Max Range
(4) NATO Sea Sparrow / 7 NM Max Range

c. Aircraft onboard Nimitz

Type	Missions / Weapons Loadout[1]
20 F-14A	CAP/Escort / 4 SPAR, 2 PHOE
28 F/A-18	Strike/CAP / **STRIKE**: 2 MK-82, 1 MK-83, / 1 HARM, 2 SWDR, 4 SPAR / **CAP/ESCORT**: 2 SWDR, 4 SPAR
8 A-6E Strike	/ 12 MK-83
6 EA-6B Jamming	/ None
3 KA-6D Tanker	/ None
2 KS-3A Tanker	/ None
8 S-3B Strike/SSC	/ 2 HARPOONS
5 E-2C AEW	/ None
6 SH-3H SAR/SSC	/ None

Weapon	Description	Range
HARPOON	Medium range ASM	72 NM
SWDR	Short range AAM	9 NM
SPAR	Medium range AAM	30 NM
PHOE	Long range AAM	60 NM
MK-82	Iron Bomb	Free Fall
MK-83	Iron Bomb	Free Fall
HARM	High speed ARM	40 NM

1. For game simplicity, these weapons loadouts are the only configurations available.
* F/A-18 aircraft can be configured for either a CAP/ESCORT or STRIKE mission.

d. CAP Stations

(1) 2 F-14 @ 260 degrees 100 nm from CV
(2) 2 F-18 @ 320 degrees 100 nm from CV
(3) 1 E-2C @ 270 degrees 50 nm from CV

2. North Korean Forces and Weapons

a. The following airbases/command centers are known. See Intelligence Brief/Summary for latest intelligence reports.

(1) Chongjin

(2) Songjin
(3) Hamhung
(4) Wonson
(5) Pyongyang
(6) Sinuiju

b. Aircraft in North Korean inventory

Aircraft	Missions / Weapons Loadout
MiG-19	Air Defense / 2 SWDR
MiG-21	Air Defense / 2 AA-2, 2 AA-8 or 4 AA-8
MiG-23	Fighter/Attack/ 2 AA-8, 2 AA-7 or 4 500-KG bombs
MiG-29	Air Defense / 6 AA-10 or 8 AA-11 or 2 AA-9
TU-16	Attack / 2 AS-5

Weapon	Description	Range
AA-2	Short range AAM	4 NM
AA-7	Medium Range AAM	19 NM
AA-8	Short Range AAM	4 NM
AA-9	Long Range AAM	70 NM
AA-10	Medium Range AAM	16 NM
AA-11	Short Range AAM	10 NM
SWDR	Short range AAM	9 NM
500KG	Iron Bomb	Free Fall
AS-5	Medium Range ASM	80 NM

c. Surface-to-Air (SAM) inventory

Weapon	Description	Range
SA-2	Medium Range SAM	20 NM
SA-3	Medium Range SAM	13 NM
SA-5	Long Range SAM	135 NM
SA-7	Short Range SAM	3 NM
ZSU-23	Short Range AAA	2 NM

APPENDIX F: PRE-SIMULATION BRIEF

A. MAP DEPICTING:

(a) Aircraft type/count
(b) Air-search radar ranges
(c) SAM sites/ranges
(d) Target area
(e) CV Task Force position (260 NM east of Wonsan)

B. SCENARIO

(a) Background
(b) Mission
(c) General ROE
    (1) overflight of South Korea, China prohibited
    (2) Protection of CV
    (3) Maximize bombs on target/Minimize aircraft losses
(d) AAW ROE
    (1) CAP - aircraft loadout fixed
    (2) 100-150 NM -- VID/Escort (if required)/Comm Air-BO
    (3) < 100 NM -- Engagement (if required)
        If NK & ORD & Warn & WRP then Engage
    (4) > 100 NM -- Engage only if lit-up
(e) ASUW ROE
    (1) Mod-Locked
    (2) < 150 NM -- ID/Track (SSC aircraft)
    (3) Engagement of NK Naval Forces
        If < 50 NM or Attack Air assets
(f) AIR-STRIKE ROE
    (1) Over Land - Weapons Free Enemy Air
    (2) Over Water - Engage only if lit-up or AAW ROE applies
    (3) MiG Sweeps are O.K. (if defensive)

C. RE-FUELING

(a) In-Flight -- feet dry : will be refueled automatically
               -- feet wet : player needs to recover or tank
               -- At 50% planes bingo
               -- over the target: dump bombs and proceed RTB

(b) Recover Aircraft : takes time to launch again during game.

D. LAUNCHING AIRCRAFT

All aircraft on alert 7, so do not need to worry about alerts.

E. ASSISTANCE

(a) Enlisted -- CAP,HELOS,S-3'S, TANKERS / FEET DRY AIRCRAFT
(b) Dave - SIMULATED STAFF MEMBER, INTEL FEED, AAW CIRCUIT

F. AIRCRAFT PACKAGE COMPOSITION

(a) Fighter/Bomber -- separation
(b) Section/Division/Single -- splitting
(c) Aircraft at 20,000 ft unless told otherwise
(d) if EA-6B in group, speed on route will be 455 knots

G. IMPORTANT COMMANDS

(a) Ships can't take a specific track
(b) Weapons free air vs weapons free enemy air
(c) Ships radars off at start of game
(d) Planes take off with radars on
(e) Jamming of EA-6B is initially off
(f) Range circles, X marks, posits, track select
(g) ASTABS - F=fuel, V=availability, A= aircraft status
G= int, C= damage

H. STRIKE PACKAGE LAUNCH

Within 15 minutes of game start.

I. MISCELLANEOUS

1. daytime mission - WX is good, visibility is good
2. All aircraft on all ships are FMC
3. Mig patrols have been common but there has been no shooting
4. Comm Air in the game
5. Each player gets 3 intel updates
6. TAKE COMMANDS ARE BETTER TO USE THAN WEAPONS FREE !
7. Need to tell us what ships you want firing missiles
8. activate RBOC and chaff on your command ONLY
9. NORTH KOREANS KNOW WHERE YOU ARE AND HAVE PERFECT INTEL.

J. BRIEF GIVEN INSIDE IN FRONT OF DISPLAY

1. LEFT BUTTON = LAT/LONG,RANGE & BEARING
2. CENTER BUTTON = HOOK TRACK : GET TN, COURSE, SPEED
3. X-MARKS, CIRCLES, ROUTES ETC.
4. YELLOW SYMBOL : FADING
5. BIG SCREEN SET-UP

APPENDIX G: SCENARIO

A. BACKGROUND

During the past few years concern for the North Korean nuclear research program has become a prime source of international importance. The North Koreans have adamantly opposed international efforts to restrict their research and development of nuclear technology. As a result, the government of North Korea has been unwilling to comply with UN nuclear weapons proliferation and research resolutions by denying UN atomic energy commission inspectors access to their nuclear research facility located at Kanggye.

After months of deliberations, the UN has finally given the US permission to conduct limited strike operations against North Korean nuclear facilities if the North Korean government does not comply with the UN resolutions. South Korea is very concerned about reprisals from the north and has elected not to participate in any offensive actions against North Korea.

The Nimitz battlegroup is already in the Sea of Japan where it has just completed conducting operations in support of Team Spirit 94 with other allied countries. In response, North Korea has upgraded its military readiness level and placed its forces on alert.

B. MISSION DESCRIPTION

The National Security Council (NSC) has ordered the Nimitz battle group to plan and conduct an air strike against the nuclear weapons research facility located at Kanggye due to the North Korean's non-compliance with UN resolutions. Because of the sensitivity of the mission and the media attention that it will generate, a TLAM strike is not authorized due to collateral damage from cruise missiles that did not reach the target. Additionally, the video coverage that is provided by aircraft on target will further support the UN position and challenge any false claims by the North Korean government about civilian casualties and excessive force being levied against their country and people.

The US mission is to destroy the North Korean nuclear weapons research facility at Kanggye. No other offensive action shall be taken against North Korean forces. Hostile aircraft and naval forces may only be engaged if they threaten the aircraft strike group or carrier battle group. Damage to the North Korean military infrastructure is not the mission objective and must be avoided at all costs. Consequently, no offensive strikes will be launched against these types of targets.

C. RULES OF ENGAGEMENT

1. General Mission Restrictions:

- US forces available consist of only the Nimitz Battle group currently located in the Sea of Japan.

- No strikes may originate from South Korea. Additionally, overflight of South Korea by aircraft is strictly prohibited.

- China has repeatedly warned that it will not tolerate any violations of its territorial waters or airspace; therefore, overflight of China is prohibited.

- Every attempt should be made to minimize aircraft losses; however, the target is classified as high risk and must be taken out at all costs.

- The survival of the Nimitz battlegroup is of paramount importance and destruction of even one ship is unacceptable.

2. Anti-Air Warfare Intentions:

- Currently two CAP stations are up and manned with a section (2) of fighters on each and one E-2C airborne and on station providing surveillance for the Nimitz battlegroup. This may be modified as desired.

- At the present time, air weapons status is yellow and hold. At no time are US aircraft to allow North Korean aircraft to gain an offensive position that would allow them to successfully strike the carrier battlegroup.

- All aircraft will be intercepted and identified when they enter within 150 nm of the Nimitz. Commercial aircraft, once identified, do not need to be covered if they continue to operate within 150 nm of the Nimitz. Military aircraft will be covered or escorted if they operate within the 150 nm boundary. Once these aircraft exit the 150 nm boundary the CAP aircraft will discontinue escort duties.

- Aircraft that enter within 100 nm of the Nimitz will be engaged only if all of the following occur:
  (a) Aircraft is North Korean
  (b) Aircraft is carrying ordnance
  (c) Attempts to warn off aircraft have been made.

- US aircraft will not engage North Korean aircraft operating in international airspace unless these

aircraft initiate hostile actions first or the guidelines outlined in (4) transpire.

3. Anti-Surface Warfare Intentions:

- US naval forces must maintain a 12 nautical mile stand-off from all coastlines.
- Primary area of responsibility (AOR) is 150 nm radius around CV. All surface contacts within this AOR will be identified and tracked. Any North Korean surface contact within 50 nm of the Nimitz will be tracked and monitored for hostile intentions. If hostile actions are indicated it may be engaged if it closes within 40 nm of the Nimitz.
- For undisclosed reasons the Nimitz battlegroup must maintain its current station; therefore, SSC missions will have to be performed with aircraft.
- Offensive actions directed against North Korean naval forces is prohibited; however, US surface or air assets that come under attack by these naval forces may respond in kind.
- The ASUW threat from North Korea is minimal but should not be totally discounted.

4. Anti-Submarine Warfare Intentions:

- None, no submarine threat.

5. Air-Strike Rules of Engagement:

- The strike package(s) will be <u>weapons free enemy air</u> once they are over land. During ingress and egress when over water the strike package(s) may not engage enemy aircraft unless they are being tracked with fire control radars.
- The strike objective is the nuclear weapons research facility located at Kanggye. The White House wants this facility <u>totally obliterated</u>; however, this facility is so large that even if all the carrier's planes were able to drop ordnance on it in a single strike, it would

still not be enough to totally destroy it. Subsequent strikes will be required; however, the greater the amount of ordnance that can be placed on target initially the better.

- Strikes against air bases and offensive MiG sweeps are not authorized. Defensive MiG sweeps, those that clear the ingress/egress path for the strike group, are authorized. SAM sites may be engaged if they are a threat to the strike group.

APPENDIX H: ORANGE FORCES SCRIPT

A. ORANGE IS WEAPONS TIGHT UNTIL BLUE INITIATES HOSTILITIES. THIS IS DEFINED BY:

- Violating North Korean airspace and/or territorial waters. In the game, this occurs when the radar defensive perimeter of the detecting base is penetrated.
- Blue aircraft engage any Orange forces.
- If one of these items take place, Orange forces are weapons free and will engage Blue forces according to the following script.

B. MIG PATROLS

At the start of the game, 3 sorties of 3 MiG-23 aircraft each will depart from Chongjin, Songjin and Wonson. These aircraft will close the carrier battle group but not close to within 100 nm of the carrier. The following routes of flight are designed to test carrier CAP aircraft and provide the player with additional tasks.

C. ORANGE FIGHTER AIRCRAFT WILL SCRAMBLE FROM THEIR RESPECTIVE BASES BASED UPON THE FOLLOWING ALGORITHM:

(a) When the Blue strike penetrates the Orange radar detection bubble for a base, 1/2 of the available fighters will scramble (from that base) to intercept the incoming strike group.

(b) The second breach of a airbase defense zone (by a different strike group) will result in Orange scrambling the other 1/2 of their fighters.

(c) Orange fighter aircraft (those already airborne and those scrambled) will intercept and engage the incoming Blue aircraft.

(d) The Orange fighters will continue to pursue and engage the attacking Blue aircraft until one of the following occurs:

1. All attacking Blue aircraft are destroyed.
2. All intercepting Orange aircraft are destroyed.
3. Orange aircraft must RTB for fuel/ordnance.
4. The Blue aircraft are retreating and close to within 100 nm of the carrier.

(e) When the Blue strike group penetrates the 50 nm perimeter around Kanggye, Orange interceptors will scramble out of Sinuiju based upon the 1/2 aircraft algorithm.

(f) NOTE: When a base scrambles aircraft to intercept a strike group that breaks its perimeter, the aircraft launched will continue the pursuit as outlined above; however, the base will not launch another intercept group against the same strike group if it again breaks its defensive bubble. For example, the Hamhung defensive border is violated by an ingressing strike. Aircraft are launched and pursue the strike group. After the attacking aircraft strike Kanggye they egress back through the Hamhung defensive zone. This time Hamhung will not launch additional interceptors because these bogeys are already engaged.

D. WEAPONS FREE FOR MIG PATROLS

The Orange MiG patrols that are launched at game start will proceed on their routes until completion and then land. However, if they are airborne and a radar bubble is broken by the Blue strike group, they will pursue and engage the striking Blue aircraft. Aircraft scrambles from the airbases will be as defined above.

E. ORANGE STRIKE PLAN

The Orange strike force will launch as soon as the Blue strike group is over Kanggye. The strike force will consist of the following:

- 4 MiG-29 and 5 Badger aircraft launched from Chongjin will compose the north strike force.

- 5 Badgers will launch from Pyongyang and will rendezvous over Hamhung with 4 MiG-29 aircraft launched from Wonson.

- 4 MiG-29 and 5 Badger aircraft launched from Wonson will compose the south strike force.

These strike groups will proceed along their routes and attack the carrier battlegroup once they reach maximum weapons release range (80 nm) and then return home. They will not break off the attack until their weapons have been released or they have been destroyed. The sole purpose of the fighter escort is to get the bombers to the weapons release point and back home again; therefore, the Orange fighter escort will not engage the egressing Blue strike group but will engage Blue CAP aircraft that attempt to intercept the Orange strike package. They will continue to provide cover for the bombers after the weapons have been released so that the bombers will have a chance to return to base. The fighter escort will not be weapons free until the package is 100 nm from the Nimitz or unless the package is attacked earlier by Blue forces.

F. ORANGE SURFACE UNIT AAW POSTURE

Orange naval forces will launch SA-7 weapons if Blue aircraft fly within range and altitude.

G. ORANGE SHORE BATTERIES

Orange shore batteries and remote SAM sites initially will not be active; however, as soon as an airbase defensive perimeter is transgressed these sites will become active and attack any Blue aircraft within range. Blue aircraft may attack these sites if they pose a direct threat to the Kanggye strike group (i.e., they are on an ingress/egress route).

H. NORTH KOREA ORDER OF BATTLE

1. Chongjin

5 Badgers (2 AS-5 Kitchen)
4 MiG-29 (6 AA-10, 30 mm gun)
10 MiG 23 (2 AA-7, 23 mm gun)
2 SA-2 and 2 SA-3 SAM sites

2. **Songjin**

10 MiG 29 (6 AA-10, 30 mm gun)
15 MiG 23 (2 AA-7, 23 mm gun)
10 MiG 21 (2 AA-2, 2 AA-8, 23 mm gun)
2 SA-3 SAM Sites

3. **Hamhung**

10 MiG 19 (Sidewinders, 2 30 mm guns)
10 MiG 23 (2 AA-7, 23 mm gun)
10 MiG 21 (2 AA-2, 2 AA-8, 23 mm gun)
2 SA-2 and 2 SA-3 SAM Sites

4. **Wonson**

10 Badgers (2 AS-5 Kitchen)
10 MiG 29 (6 AA-10, 30 mm gun)
15 MiG 23 (2 AA-7, 23 mm gun)
3 SA-2 and 1 SA-3 SAM sites

5. **Pyongyang**

10 Badgers (2 AS-5 Kitchen)
10 MiG 29 (6 AA-10, 30 mm gun)
20 MiG 23 (2 AA-7, 23 mm gun)
20 MiG 21 (2 AA-2, 2 AA-8, 23 mm gun)
10 MiG 19 (rockets, 2 30 mm guns)
4 SA-2, 4 SA-3 and 4 SA-5 SAM sites

6. **Sinuiju**

40 MiG 21 (2 AA-2, 2 AA-8, 23 mm gun)
3 SA-2 SAM Sites

7. **Kanggye (TARGET)**

3 SA-2 and 2 SA-3 SAM Sites
2 ZSU-23 AAA sites

8. **No Submarines (Blue or Orange).**

9. **North Korean naval forces and neutral fishing vessels located in various locations in the Sea of Japan and Yellow Sea.**

10. North Korean shore batteries scattered along coast and specific inland sites. These batteries contain SA-2, SA-3, SA-7 and ZSU-23 components.

11. Aircraft training flights at game start:
    a. Flight of 3 MiG 23's from Chongjin.
    b. Flight of 3 MiG 23's from Songjin.
    c. Flight of 3 MiG 23's from Wonson.

APPENDIX I: INTELLIGENCE UPDATE PROCEDURES

A. INTRODUCTION

The primary premise of this thesis is to assess what different levels of information have upon tactical decision-making with regards to offensive strike capability and defensive posture of a carrier battlegroup. To accomplish a test of this hypothesis it was decided to give the commander (the player) an initial intelligence brief based on the degree of resolution for that particular run of the game, and then supply the player with updates of the tactical situation at three discrete places in the game, those updates also being of the same resolution of the initial intel brief. The three times chosen for the information to be passed to the commander are as follows:

1. First Update Message

This message is given to the player upon initial detection of the Blue Strike Group by Orange Forces. These messages will supply the player with enemy air activity, and the information content and flow will depend upon the resolution of the particular run. This would be the first critical decision point in the game and would give the Blue player the opportunity to vary tactics such as ingress routes and strike defensive posture.

2. Second Update Message

The second information update was given when the Blue Strike Group closed within 50 miles of the target. This gives the player a chance to make decisions with regard to carrier defense and the most efficient way to recover the inbound Blue Strike Package upon their return.

3. Third Update Message

The third update consisted of current information concerning enemy reaction when the initial Blue aircraft reached the target area. This information was critical for determining the best egress route for the strike package and also for helping the commander with the defensive posture of his forces.

B. MESSAGE UPDATES

1. Very Low Intelligence, First Update Message

VL
XX0015ZFEB94
FM CTF 77
TO CTG 77.1

SUBJ: KOREAN THEATER INTELLIGENCE UPDATE REPORT (VL-1)

1. The North Korean Air defense Control Center located at _____ has been activated in response to the detection of unidentified aircraft that appear to be a threat to North Korea. Air-search radars located at _____ have detected the threat.

2. Various SAM battery aquisition radars have been activated; locations unknown.

3. Increased communications activity between Hamhung and various bases in North Korea. Standby for further updates.

2. Very Low Intelligence, Second Update Message

VL
XX0015ZFEB94
FM CTF 77
TO CTG 77.1

SUBJ: KOREAN THEATER INTELLIGENCE UPDATE REPORT (VL-2)

1. Increased air activity at Sinuiju has been observed.

2. Numerous SAM sites have been activated; Kanggye is known to be active.

3. Communications between Hamhung, Chongjin, Wonson and Pyongyang concerning alert aircraft status.

3. Very Low Intelligence, Third Update Message

VL
XX0015ZFEB94
FM CTF 77
TO CTG 77.1

SUBJ: KOREAN THEATER INTELLIGENCE UPDATE REPORT (VL-3)

1. Aircraft have been launched from Chongjin, Hamhung and Wonson. The type, number of aircraft and course is unknown.

2. All SAM sites are active and weapons free.

4. Low Resolution Intelligence, First Update Message

L
FM CTF 77
TO CTG 77.1

SUBJ: KOREAN THEATER INTELLIGENCE UPDATE REPORT (L-1)

1. The North Korean Air defense Control Center located at _____ has been activated in response to the detection of unidentified aircraft that appear to be a threat to North Korea. Air-search radars located at _____ have detected the threat and the base has begun to launch fighter aircraft.

2. SA-3 SAM emissions in the _____ area have been detected.

3. Increased communications activity from Hamhung to selected bases in North Korea. Intelligence reports that Hamhung has released an order concerning plan "B" execution. Contents of this message are unknown at this time. Standby for further updates.

5. Low Resolution Intelligence, Second Update Message

L
FM CTF 77
TO CTG 77.1

SUBJ: KOREAN THEATER INTELLIGENCE UPDATE REPORT (L-2)

1. Sinuiju is launching numerous aircraft. The type, number of aircraft and course is unknown.

2. SA-2 and SA-3 emissions in the Kanggye area have been detected. SA-5 emissions in the Pyongyang area have been detected and all other SAM sites are suspected to be active.

3. Communications between Hamhung, Chongjin, Wonson and Pyongyang concerning aircraft rendezvous positions have been intercepted.

6. Low Resolution Intelligence, Third Update Message

L
FM CTF 77
TO CTG 77.1

SUBJ: KOREAN THEATER INTELLIGENCE UPDATE REPORT (L-3)

1. Three flights of aircraft have been launched from Chongjin, Hamhung and Wonson. The type and number of aircraft is unknown; however, they do not appear to be headed for Kanggye.

2. All SAM sites in North Korea are active and weapons free.

7. Medium Resolution Intelligence, First Update Message

M
XX0015ZFEB94
FM CTF 77
TO CTG 77.1

SUBJ: KOREAN THEATER INTELLIGENCE UPDATE REPORT (M-1)

1. The North Korean Air defense Control Center located at _____ has been activated in response to the detection of unidentified aircraft that appear to be a threat to North Korea. Air-search radars located at _____ have detected the threat and the base has already launched _____ fighter aircraft and is continuing to launch more aircraft.

2. SA-2 and SA-3 SAM emissions in the _____ and Kanggye area have been detected.

3. Increased communications activity from Hamhung to Chongjin, Wonson and Pyongyang. Intelligence reports that Hamhung has released an order concerning Badger and MiG rendezvous positions. Contents of this message are unknown at this time. Standby for further updates.

8. Medium Resolution Intelligence, Second Update Message

M
XX0015ZFEB94
FM CTF 77
TO CTG 77.1

SUBJ: KOREAN THEATER INTELLIGENCE UPDATE REPORT (M-2)

1. Sinuiju is launching numerous MiG-21 aircraft. Ten have already taken off and more are launching. The destination and mission of the aircraft is unknown but the aircraft are headed northeast.

2. All SAM sites in North Korea are active and weapons free.

3. Communications between Hamhung, Chongjin, Wonson and Pyongyang have been intercepted. Contents include Badger and MiG rendezvous positions and flight routes.

9. Medium Resolution Intelligence, Third Update Message

M
XX0015ZFEB94
FM CTF 77
TO CTG 77.1

SUBJ: KOREAN THEATER INTELLIGENCE UPDATE REPORT (M-3)

1. Three flights of Badger and MiG-29 aircraft have been launched from Chongjin, Hamhung and Wonson. The exact number

of each aircraft is unknown. The Badgers are believed to be loaded with AS-5 Kelt missiles. These flights appear to be headed out to sea.

10. High Resolution Intelligence, First Update Message

H
FM CTF 77
TO CTG 77.1

SUBJ: KOREAN THEATER INTELLIGENCE UPDATE REPORT (H-1)

1. The North Korean Air defense Control Center located at _____ has been activated in response to the detection of unidentified aircraft that appear to be a threat to North Korea. Air-search radars located at _____ have detected the threat and the base is launching _____ fighter aircraft to intercept and engage the threat.

2. SAM bases throughout the country have been activated and all have received a weapons free order and will engage any enemy aircraft within range.

3. Increased communications activity from Hamhung to Chongjin, Wonson and Pyongyang. Intelligence reports that Hamhung has released an order concerning Badger and MiG rendezvous positions for the upcoming retaliatory action against the U.S. forces.

11. High Resolution Intelligence, Second Update Message

H
FM CTF 77
TO CTG 77.1

SUBJ: KOREAN THEATER INTELLIGENCE UPDATE REPORT (H-2)

1. Sinuiju is launching 20 MiG-21 aircraft. These aircraft are headed for Kanggye to engage the U.S. strike package enroute.

12. High Resolution Intelligence, Third Update Message

H
FM CTF 77
TO CTG 77.1

SUBJ: KOREAN THEATER INTELLIGENCE UPDATE REPORT (H-3)

1. Three flights of 5 Badger and 4 MiG-29 aircraft have been launched from Chongjin, Hamhung and Wonson. The Badgers are loaded with 3 AS-5 Kelt missiles per aircraft. These flights appear to be headed for the U.S. carrier task force in retaliation for the U.S. strike against North Korea.

APPENDIX J: PLAYER DEBRIEF

1. Name:_____Resolution:_____

2. Mission Planning:

   (a) Why did you choose the strike ingress route that you did? What factors influenced your decision?

   (b) How did you determine the number and type of aircraft that you utilized in your strike package? What factors influenced your decision?

   (c) Why did you choose the strike egress route that you did? What factors influenced your decision?

   (d) Was the initial intelligence brief helpful in planning the strike package composition and CV defensive posture?

   (e) Were the intelligence updates helpful in modifying your strike plan and/or defending the task force? If yes, how was the information useful?

3. Intelligence Data:

   (a) What items in the initial brief were the most helpful in assessing the situation. Rank the following items from most important to least:

   ( ) Aircraft data: number/type
   ( ) SAM data: type/location
   ( ) Logistics data: urgency/contents
   ( ) Communications traffic: contents/density
   ( ) Enemy air surveillance data: locations/ranges
   ( ) Defense Strategy

   (b) Was there any type of information, not included in the initial brief, that would have influenced the way you formulated your initial strategy and plans?

APPENDIX K: ENGAGEMENT LOG

A. SUMMARY OF AIRCRAFT LOST

TIME	TARGET	WEAPON	FIRING PLATFORM	DAMAGED BASE/SHIP
020128Z	VF203	AA7	FL404	
020130Z	FL404	SWDR	VF224	
020130Z	FL405	SWDR	VF224	
020130Z	VQ200	AA7	FL400	
020130Z	VF202	AA7	FL404	
020131Z	FU401	SPAR	VF224	
020131Z	FL403	PHENX	VF204	
020132Z	VF224	AA10	FU400	
020132Z	VF225	AA10	FU400	
020132Z	FU400	SWDR	VF224	
020133Z	FL400	SPAR	VF228	
020133Z	FL401	SPAR	VF228	
020134Z	VF204	SA2	SA202	
020135Z	FL402	SPAR	VF205	
020136Z	VA204	SA5	PYONG	
020140Z	FL500	SWDR	VF228	
020140Z	VA207	AA7	FL500	
020141Z	VA205	AA7	FL501	
020143Z	FL501	SPAR	VF228	
020146Z	VA200	SA2	SA202	
020148Z	VF236	SA2	SA201	
020148Z	VQ203	SA2	SA202	
020149Z	VF205	AA10	FU402	
020150Z	VF232	SA2	SA201	
020152Z	VF234	AA10	FU404	
020152Z	VF235	AA10	FU404	
020153Z	VF230	AA10	FU404	
020154Z	VF231	AA10	FU404	
020156Z	VA206	SA2	SA201	
020206Z	VF206	AA10	FU300	
020206Z	VF207	AA10	FU300	
020215Z	FU205	SWDR	VF200	
020215Z	FU206	SWDR	VF200	

etc.

B. LIST OF ALL ENGAGEMENTS

TIME	PLATFORM	WEAPON	TRACK	TARGET	RESULT	RANGE	MBURANGE
020118Z	SOHO	G1001	OA013	VQ203	M(1)	8	191
020118Z	SA201	SA2	OA007	VF224	M(20)	7	201
020119Z	SOHO	G1001	OA013	VQ203	M(1)	8	198
020120Z	SA201	SA2	OA010	VF232	M(20)	6	214
020122Z	SA202	SA2	OA007	VF224	M(20)	22	227
020124Z	PYONG	SA5	OA013	VQ203	M(25)	128	231
020124Z	SA202	SA2	OA008	VF202	M(20)	8	240
020124Z	SA203	SA2	OA008	VF202	M(20)	23	240
020126Z	SA202	SA2	OA010	VF232	M(20)	5	254
020126Z	SA203	SA2	OA010	VF232	M(20)	19	254
020127Z	PYONG	SA5	OA016	VF230	M(25)	117	251
020128Z	FL404	AA7	OA008	VF202	M(60)	19	267
020128Z	FL404	AA7	OA008	VF202	H	19	267
020128Z	SPLASH	ENGAGE		VF203	H	0	0
020129Z	FL404	AA7	OA008	VF202	M(60)	14	273
020130Z	VF224	SWDR	BA200	FL404	H	9	270
020130Z	SPLASH	ENGAGE		FL404	H	0	0
020130Z	VF224	SWDR	BA200	FL404	H	9	270
020130Z	SPLASH	ENGAGE		FL405	H	0	0
020130Z	VF204	PHENX	BA200	FL404	H	37	270
020130Z	VF204	PHENX	BA200	FL404	H	37	270
020130Z	VF228	SWDR	BA200	FL404	H	9	270
020130Z	VF228	SWDR	BA200	FL404	M(50)	9	270
020130Z	VF232	SWDR	BA200	FL404	H	9	270
020130Z	VF232	SWDR	BA200	FL404	H	9	270
020130Z	VF236	SWDR	BA200	FL404	M(50)	9	270
020130Z	VF236	SWDR	BA200	FL404	M(50)	9	270
020130Z	FL400	AA7	OA006	VQ200	H	20	279
020130Z	SPLASH	ENGAGE		VQ200	H	0	0
020130Z	FL402	AA7	OA006	VQ200	H	16	279
020130Z	FL404	AA7	OA008	VF202	H	16	285
020130Z	SPLASH	ENGAGE		VF202	H	0	0
020131Z	VF224	SPAR	BA255	FU400	M(65)	23	270
020131Z	VF224	SPAR	BA255	FU400	H	23	270
020131Z	SPLASH	ENGAGE		FU401	H	0	0
020131Z	VF204	PHENX	BA255	FL402	M(70)	48	256
020131Z	VF204	PHENX	BA255	FL402	H	48	256
020131Z	SPLASH	ENGAGE		FL403	H	0	0
020131Z	VF228	SPAR	BA255	FU400	M(65)	23	270
020131Z	VF228	SPAR	BA255	FU400	H	23	270
020132Z	KANGY	SA2	OA010	VF232	M(20)	22	297

etc.

APPENDIX L: DATA TABULATION TABLE

NAME: _____ **RESOLUTION:** _____

Strike Package information:

- Number of packages: _____
- Support Package(s): _____
- Composition:

STK A-6E:_____F/A-18(B):_____EA-6B:_____
SUP F-14:_____F/A-18(E):_____Other:_____ VW/KA/VS

STK A-6E:_____F/A-18(B):_____EA-6B:_____
SUP F-14:_____F/A-18(E):_____Other:_____ VW/KA/VS

STK A-6E:_____F/A-18(B):_____EA-6B:_____
SUP F-14:_____F/A-18(E):_____Other:_____ VW/KA/VS

STK A-6E:_____F/A-18(B):_____EA-6B:_____
SUP F-14:_____F/A-18(E):_____Other:_____ VW/KA/VS

Notes:

CAP Package information

- Composition:

CAP F-14:_____F/A-18:_____
SUP E-2C:_____TANKER:_____S-3:_____ EA-6B:_____

Ingress/Target Losses

Strike	Air/SAM Escort	Air/SAM Strk Sup	Air/SAM	Air NK

Egress Losses

Strike	Air/SAM Escort	Air/SAM Strk Sup	Air/SAM	Air NK

Red Strike Losses

TU-16	MiG-29	US CAP	Def Sup

TU-16 Lnchng Miss: **Missiles Impacting:**

```
# Strike Launched:              # NK Fght Lost During Ingress:
# Escort Launched:              # NK Fght Lost During Egress:
# StkSup Launched:              # NK Escort Lost During Strike:
# Strike Reaching Target:       # NK Badgers Lost During Strike:
# Escort Reaching Target:       # NK Badgers Launching Missiles:
# StkSup Reaching Target:
# Strike Lost During Egress:
# Escort Lost During Egress:
# StkSup Lost During Egress:
# CAP Lost During NK Strike:
# DefSup Lost During NK Stk:
```

APPENDIX M: ANALYSIS

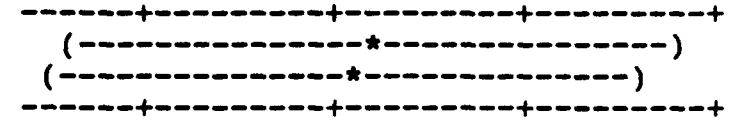
A. ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft that reach the Target from *Both* communities based on Warfare Specialty.

SOURCE	DF	SS	MS	F	p
War Spec	1	1.0	1.0	0.02	0.898
ERROR	22	1372.6	62.4		
TOTAL	23	1373.6			

LEVEL	N	MEAN	STDEV
0	12	18.583	9.040
1	12	18.167	6.562

POOLED STDEV = 7.899

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



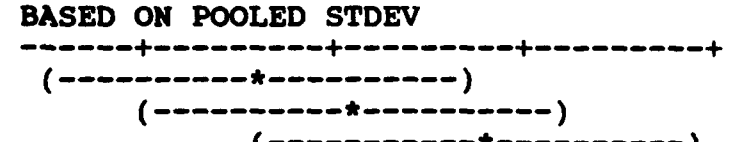
B. ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft that reach the Target from *Both* communities based on *Four* Information Levels.

SOURCE	DF	SS	MS	F	p
Level	3	164.1	54.7	0.90	0.456
ERROR	20	1209.5	60.5		
TOTAL	23	1373.6			

LEVEL	N	MEAN	STDEV
0	6	15.333	7.916
1	6	18.333	7.916
2	6	22.500	9.482
3	6	17.333	5.164

POOLED STDEV = 7.777

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



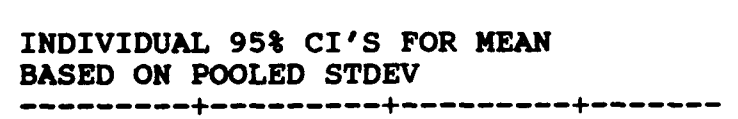
C. ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft from the *TACAIR* community that reach the Target based on *Four* Information Levels.

SOURCE	DF	SS	MS	F	p
Level	3	72	24	0.23	0.872
ERROR	8	827	103		
TOTAL	11	899			

LEVEL	N	MEAN	STDEV
0	3	18.00	7.94
1	3	19.67	11.50
2	3	21.67	13.05
3	3	15.00	6.93

POOLED STDEV = 10.17

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



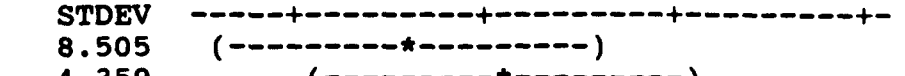
D. ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft from the *NON TACAIR* community that reach the Target based on *Four* Information Levels.

SOURCE	DF	SS	MS	F	p
Level	3	181.7	60.6	1.66	0.252
ERROR	8	292.0	36.5		
TOTAL	11	473.7			

LEVEL	N	MEAN	STDEV
0	3	12.667	8.505
1	3	17.000	4.359
2	3	23.333	7.234
3	3	19.667	1.528

POOLED STDEV = 6.042

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



E. MEAN VALUE DIFFERENTIAL ANALYSIS ON the *Number* of Strike Aircraft reaching the Target: *Four* Information Levels.

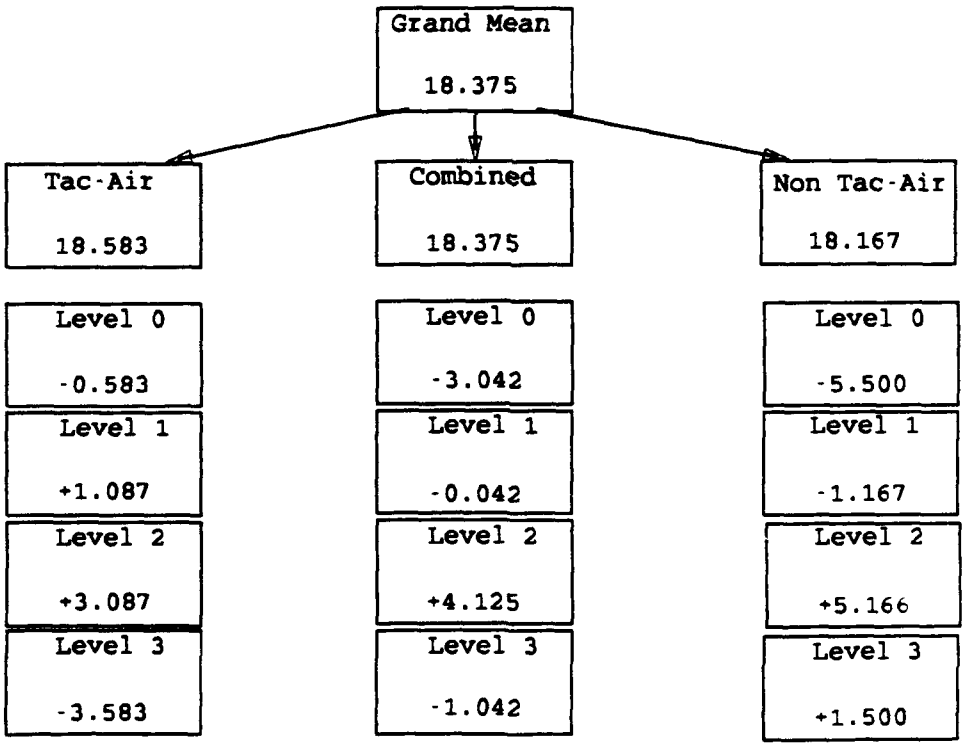


Figure 1

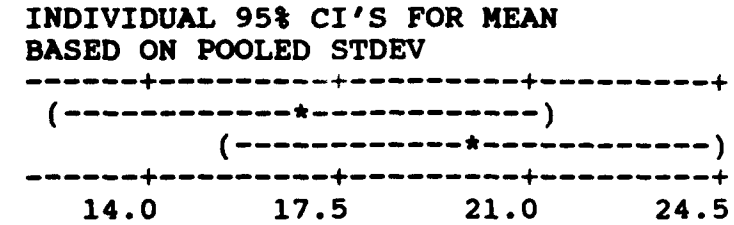
F. ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft that reach the Target from *Both* communities based on *TWO* Information Levels.

SOURCE	DF	SS	MS	F	p
Level	1	57.0	57.0	0.95	0.340
ERROR	22	1316.6	59.8		
TOTAL	23	1373.6			

LEVEL	N	MEAN	STDEV
0	12	16.833	7.709
1	12	19.917	7.763

POOLED STDEV = 7.736

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



G. ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft that reach the Target from the *TACAIR* community based on *TWO* Information Levels.

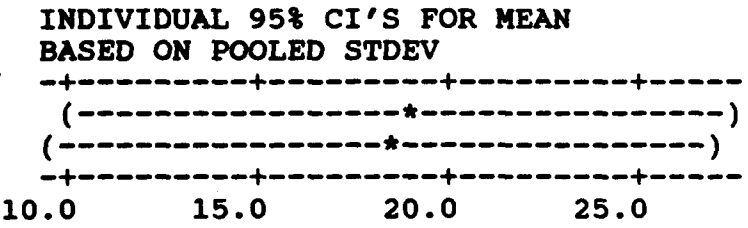
ANALYSIS OF VARIANCE ON Stk TGT

SOURCE	DF	SS	MS	F	p
Level	1	0.8	0.8	0.01	0.929
ERROR	10	898.2	89.8		
TOTAL	11	898.9			

LEVEL	N	MEAN	STDEV
0	6	18.833	8.886
1	6	18.333	10.033

POOLED STDEV = 9.477

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



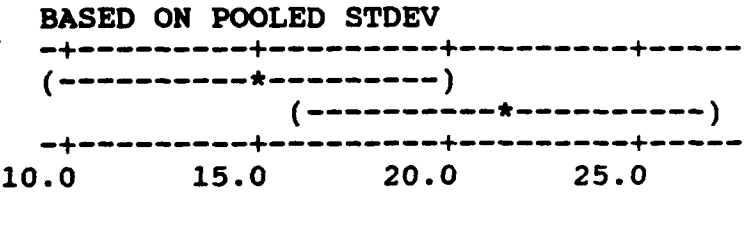
H. ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft that reach the Target from the *NON-TACAIR* community based on *TWO* Information Levels.

SOURCE	DF	SS	MS	F	p
Level	1	133.3	133.3	3.92	0.076
ERROR	10	340.3	34.0		
TOTAL	11	473.7			

LEVEL	N	MEAN	STDEV
0	6	14.833	6.494
1	6	21.500	5.089

POOLED STDEV = 5.834

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



I. **MEAN VALUE DIFFERENTIAL ANALYSIS ON the *Number* of Strike Aircraft reaching the Target: *Two* Information Levels.**

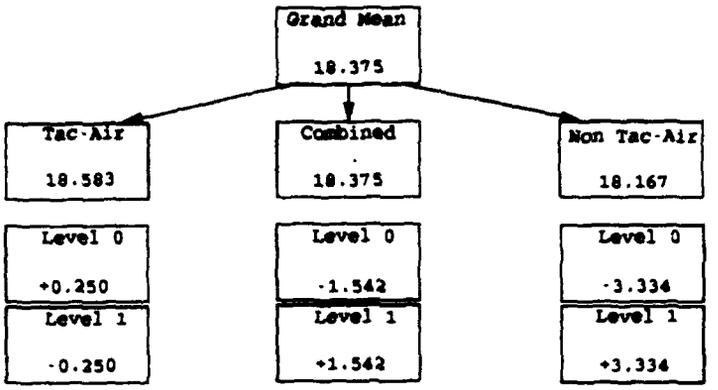


Figure 2

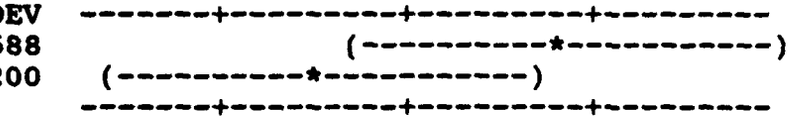
J. **ANALYSIS OF VARIANCE ON the *Percent* of Strike Aircraft that reach the Target from *Both* communities based on Warfare Specialty.**

SOURCE	DF	SS	MS	F	p
War Spec	1	0.1047	0.1047	2.84	0.106
ERROR	22	0.8095	0.0368		
TOTAL	23	0.9141			

LEVEL	N	MEAN	STDEV
0	12	0.8845	0.1588
1	12	0.7525	0.2200

POOLED STDEV = 0.1918

INDIVIDUAL 95% CI'S FOR MEAN
BASED ON POOLED STDEV



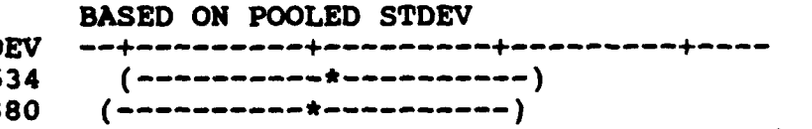
K. **ANALYSIS OF VARIANCE ON the *Percent* of Strike Aircraft that reach the Target from *Both* communities based on *Two* Information Levels.**

SOURCE	DF	SS	MS	F	p
Level	3	0.1733	0.0578	1.56	0.230
ERROR	20	0.7408	0.0370		
TOTAL	23	0.9141			

LEVEL	N	MEAN	STDEV
0	6	0.7604	0.2634
1	6	0.7436	0.2380
2	6	0.9593	0.0646
3	6	0.8107	0.1340

POOLED STDEV = 0.1925

INDIVIDUAL 95% CI'S FOR MEAN
BASED ON POOLED STDEV



L. ANALYSIS OF VARIANCE ON the *Percent* of Strike Aircraft that reach the Target from the *TACAIR* community based on *Four* Information Levels.

SOURCE	DF	SS	MS	F	p
Level	3	0.0454	0.0151	0.52	0.679
ERROR	8	0.2318	0.0290		
TOTAL	11	0.2772			

LEVEL	N	MEAN	STDEV	INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV
0	3	0.8750	0.1250	(----------*----------)
1	3	0.8229	0.2801	(----------*----------)
2	3	0.9861	0.0241	(----------*----------)
3	3	0.8542	0.1458	(----------*----------)

POOLED STDEV = 0.1702 0.60 0.80 1.00 1.20

M. ANALYSIS OF VARIANCE ON the *Percent* of Strike Aircraft that reach the Target from the *NON-TACAIR* community based on *Four* Information Levels.

SOURCE	DF	SS	MS	F	p
Level	3	0.1554	0.0518	1.10	0.404
ERROR	8	0.3768	0.0471		
TOTAL	11	0.5322			

LEVEL	N	MEAN	STDEV	INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV
0	3	0.6458	0.3442	(----------*----------)
1	3	0.6642	0.2104	(----------*----------)
2	3	0.9325	0.0878	(----------*----------)
3	3	0.7673	0.1340	(----------*----------)

POOLED STDEV = 0.2170 0.50 0.75 1.00 1.25

N. MEAN VALUE DIFFERENTIAL ANALYSIS ON the *Percent* of Strike Aircraft reaching the Target: *Four* Information Levels.

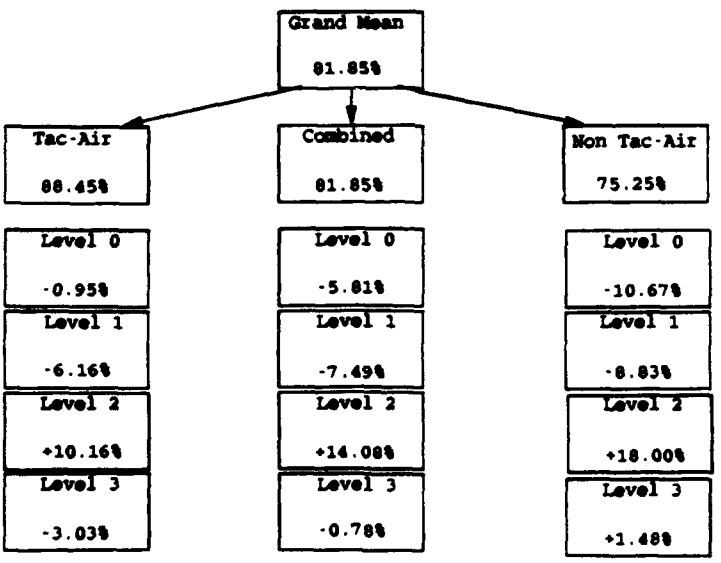


Figure 2

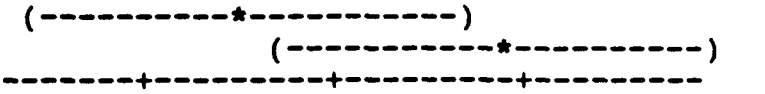
O. ANALYSIS OF VARIANCE ON the *Percent* of Strike Aircraft that reach the Target from *Both* communities based on *Two* Information Levels.

SOURCE	DF	SS	MS	F	p
Level	1	0.1062	0.1062	2.89	0.103
ERROR	22	0.8079	0.0367		
TOTAL	23	0.9141			

LEVEL	N	MEAN	STDEV
0	12	0.7520	0.2395
1	12	0.8850	0.1268

POOLED STDEV = 0.1916

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



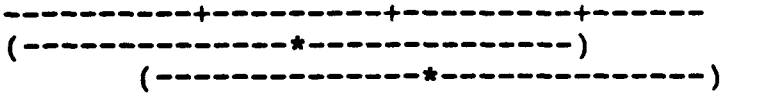
P. ANALYSIS OF VARIANCE ON the *Percent* of Strike Aircraft that reach the Target from the *TACAIR* community based on *Two* Information Levels.

SOURCE	DF	SS	MS	F	p
Level	1	0.0152	0.0152	0.58	0.464
ERROR	10	0.2620	0.0262		
TOTAL	11	0.2772			

LEVEL	N	MEAN	STDEV
0	6	0.8490	0.1961
1	6	0.9201	0.1182

POOLED STDEV = 0.1619

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



Q. ANALYSIS OF VARIANCE ON the *Percent* of Strike Aircraft that reach the Target from the *NON-TACAIR* community based on *Two* Information Levels.

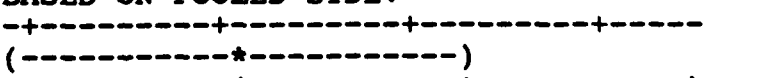
ANALYSIS OF VARIANCE ON %Stk TGT

SOURCE	DF	SS	MS	F	p
Level	1	0.1140	0.1140	2.72	0.130
ERROR	10	0.4183	0.0418		
TOTAL	11	0.5322			

LEVEL	N	MEAN	STDEV
0	6	0.6550	0.2554
1	6	0.8499	0.1358

POOLED STDEV = 0.2045

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



R. **MEAN VALUE DIFFERENTIAL ANALYSIS ON the *Percent* of Strike Aircraft reaching the Target: *Two* Information Levels.**

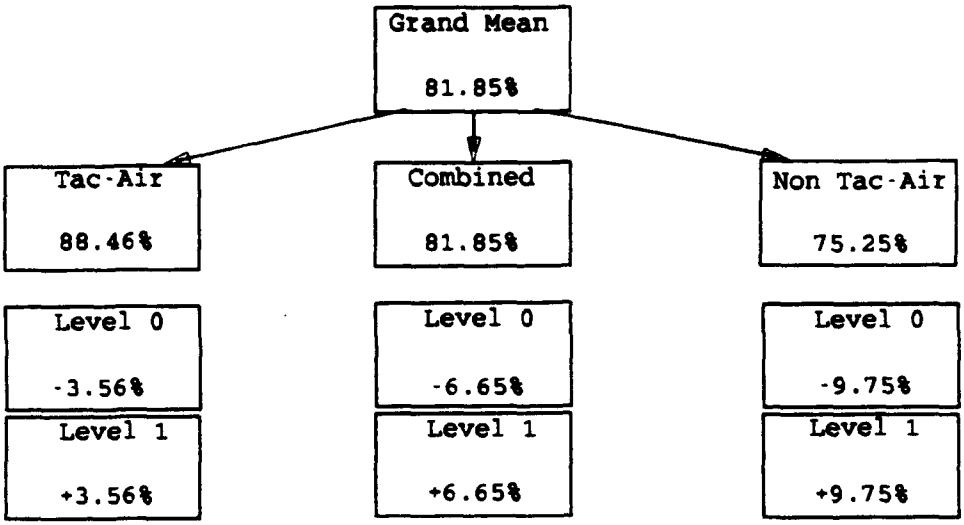


Figure 4

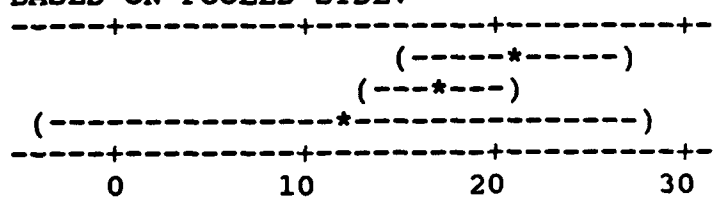
S. **ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft reaching the Target based on the *Number* of Strike Packages launched. *Both* communities.**

SOURCE	DF	SS	MS	F	p
StrkPack	2	117.4	58.7	0.98	0.391
ERROR	21	1256.2	59.8		
TOTAL	23	1373.6			

LEVEL	N	MEAN	STDEV
1	8	21.125	8.459
2	15	17.333	7.345
3	1	12.000	0.000

POOLED STDEV = 7.734

INDIVIDUAL 95% CI'S FOR MEAN
BASED ON POOLED STDEV



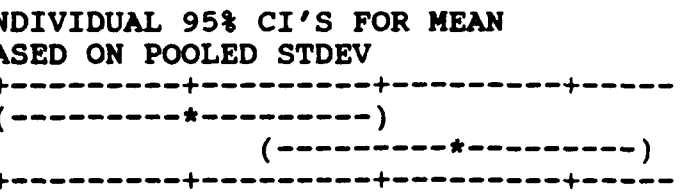
T. ANALYSIS OF VARIANCE ON the *Number* of Strike Packages launched based on the Warfare Specialty.

SOURCE	DF	SS	MS	F	p
War Spec	1	1.042	1.042	3.87	0.062
ERROR	22	5.917	0.269		
TOTAL	23	6.958			

LEVEL	N	MEAN	STDEV
0	12	1.5000	0.5222
1	12	1.9167	0.5149

POOLED STDEV = 0.5186

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



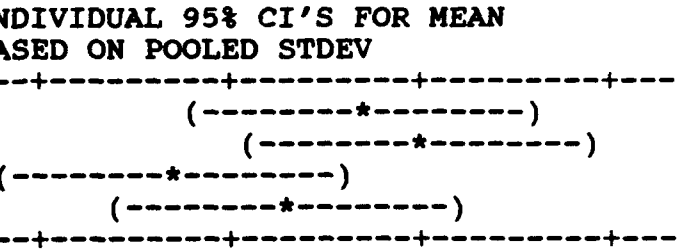
U. ANALYSIS OF VARIANCE ON the *Number* of Strike Packages launched based on *Four* Information Levels; *Both* communities.

SOURCE	DF	SS	MS	F	p
Level	3	1.458	0.486	1.77	0.186
ERROR	20	5.500	0.275		
TOTAL	23	6.958			

LEVEL	N	MEAN	STDEV
0	6	1.8333	0.4082
1	6	2.0000	0.6325
2	6	1.3333	0.5164
3	6	1.6667	0.5164

POOLED STDEV = 0.5244

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



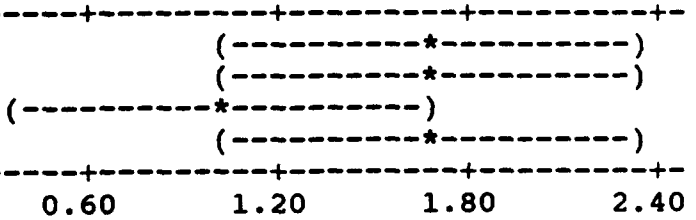
V. ANALYSIS OF VARIANCE ON the *Number* of Strike Packages launched based on *Four* Information Levels; *TACAIR* community.

SOURCE	DF	SS	MS	F	p
Level	3	1.000	0.333	1.33	0.330
ERROR	8	2.000	0.250		
TOTAL	11	3.000			

LEVEL	N	MEAN	STDEV
0	3	1.6667	0.5774
1	3	1.6667	0.5774
2	3	1.0000	0.0000
3	3	1.6667	0.5774

POOLED STDEV = 0.5000

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



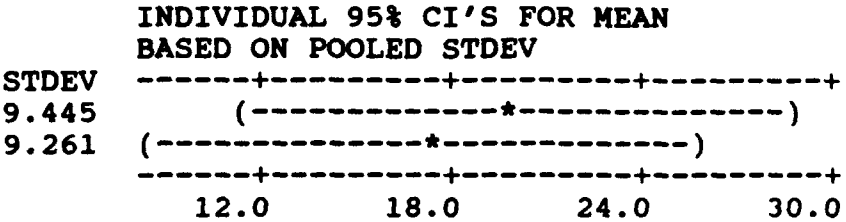
W. ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft reaching the Target based on the *Number* of Strike Packages launched; *TACAIR* community.

SOURCE	DF	SS	MS	F	p
StrkPack	1	24.1	24.1	0.28	0.611
ERROR	10	874.8	87.5		
TOTAL	11	898.9			

LEVEL	N	MEAN	STDEV
1	6	20.000	9.445
2	6	17.167	9.261

POOLED STDEV = 9.353

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



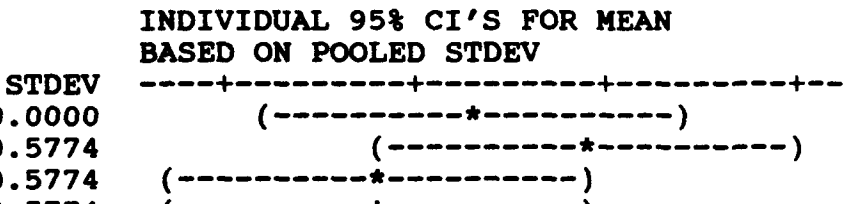
X. ANALYSIS OF VARIANCE ON the *Number* of Strike Packages launched based on *Four* Information Levels; *NON-TACAIR* community.

SOURCE	DF	SS	MS	F	p
Level	3	0.917	0.306	1.22	0.363
ERROR	8	2.000	0.250		
TOTAL	11	2.917			

LEVEL	N	MEAN	STDEV
0	3	2.0000	0.0000
1	3	2.3333	0.5774
2	3	1.6667	0.5774
3	3	1.6667	0.5774

POOLED STDEV = 0.5000

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



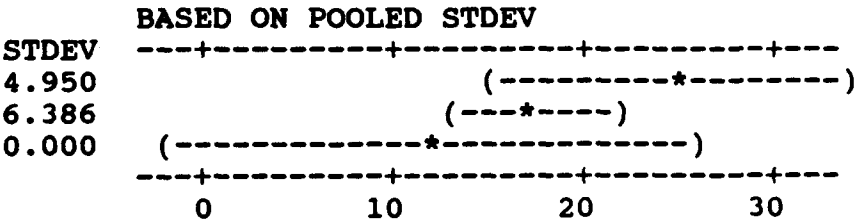
Y. ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft reaching the Target based on the *Number* of Strike Packages launched; *NON-TACAIR* community.

SOURCE	DF	SS	MS	F	p
StrkPack	2	122.9	61.5	1.58	0.259
ERROR	9	350.7	39.0		
TOTAL	11	473.7			

LEVEL	N	MEAN	STDEV
1	2	24.500	4.950
2	9	17.444	6.386
3	1	12.000	0.000

POOLED STDEV = 6.243

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



Z. ***NUMBER*** OF STRIKE AIRCRAFT reaching Target based on the ***Number*** of Strike Packages launched: ***Both*** communities.

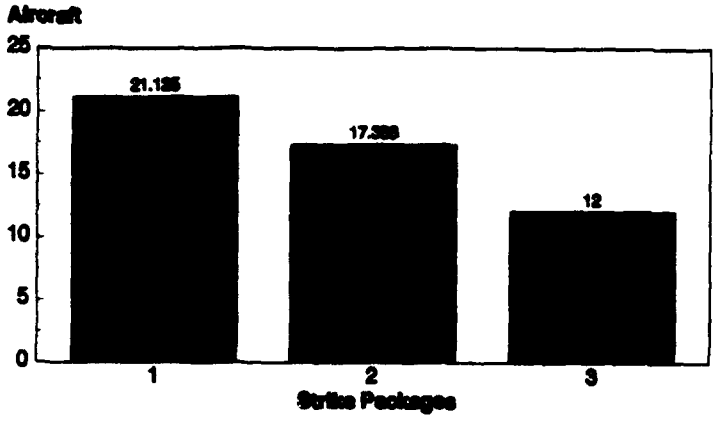


Figure 5

AA. ***NUMBER*** OF Strike Aircraft launched based on the Warfare Specialty and Information Level: ***Both*** communities.

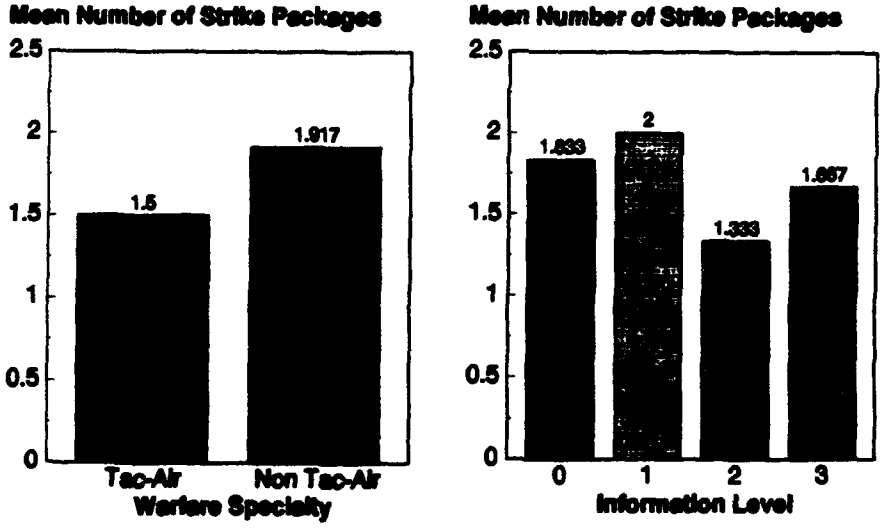


Figure 6

AB. ***MEAN NUMBER*** OF Strike Packages launched and ***MEAN NUMBER*** OF Strike Aircraft reaching Target based on ***Four*** Information Levels: ***TACAIR*** community.

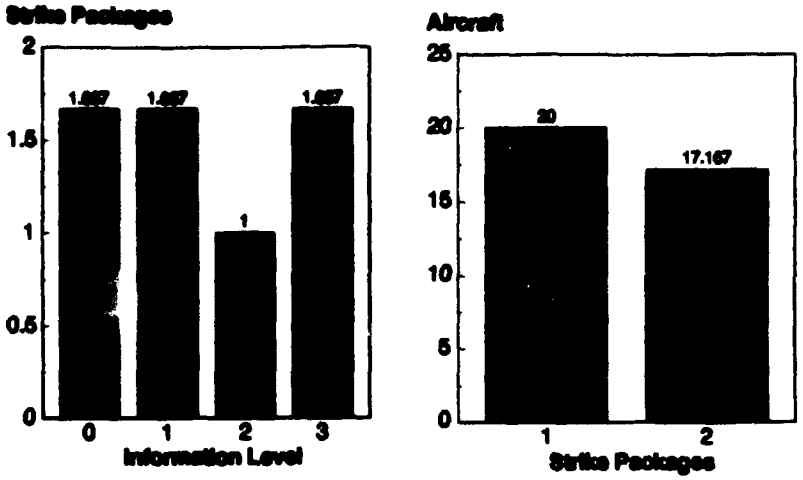


Figure 7

AC. ***MEAN NUMBER*** OF Strike Packages launched and ***MEAN NUMBER*** OF Strike Aircraft reaching Target based on ***Four*** Information Levels: ***Non TACAIR*** community.

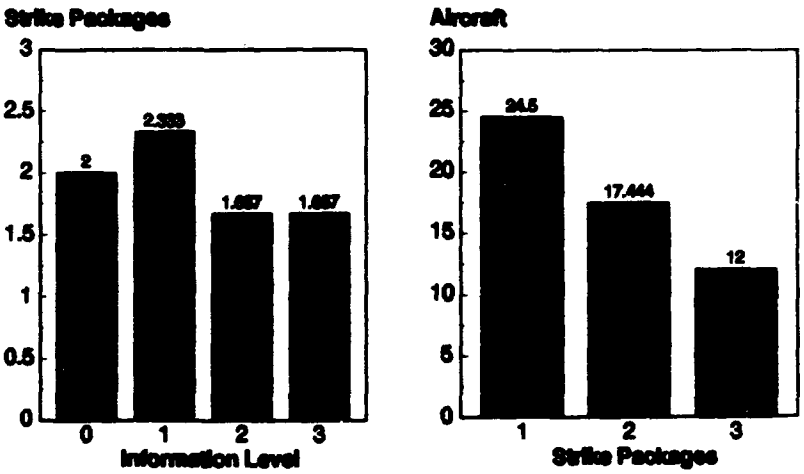


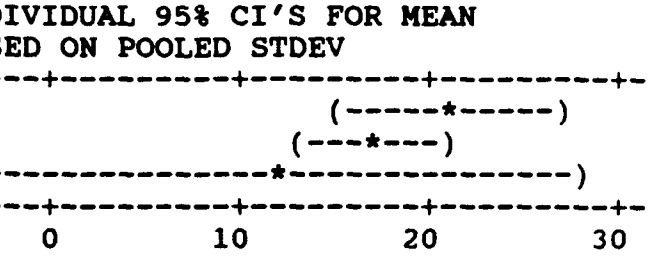
Figure 8

AD. ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft reaching the Target based on the *Number* of Strike Packages launched. *Both* communities.

SOURCE	DF	SS	MS	F	p
StrkPack	2	117.4	58.7	0.98	0.391
ERROR	21	1256.2	59.8		
TOTAL	23	1373.6			

LEVEL	N	MEAN	STDEV
1	8	21.125	8.459
2	15	17.333	7.345
3	1	12.000	0.000

POOLED STDEV = 7.734

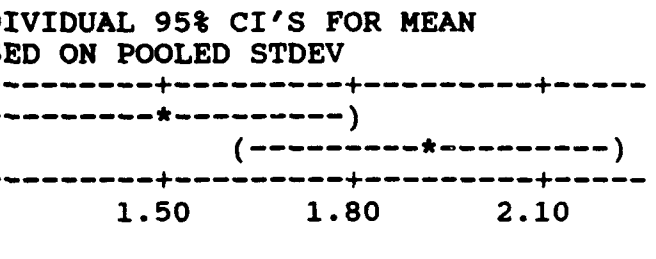


AE. ANALYSIS OF VARIANCE ON the *Number* of Strike Packages launched based on the Warfare Specialty. *Both* communities.

SOURCE	DF	SS	MS	F	p
War Spec	1	1.042	1.042	3.87	0.062
ERROR	22	5.917	0.269		
TOTAL	23	6.958			

LEVEL	N	MEAN	STDEV
0	12	1.5000	0.5222
1	12	1.9167	0.5149

POOLED STDEV = 0.5186



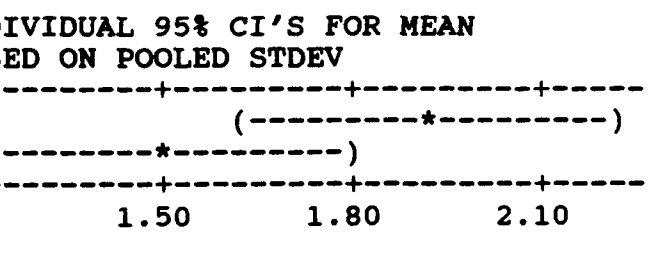
AF. ANALYSIS OF VARIANCE ON the *Number* of Strike Packages launched based on *Two* Information Levels. *Both* communities.

ANALYSIS OF VARIANCE ON StrkPack

SOURCE	DF	SS	MS	F	p
Level	1	1.042	1.042	3.87	0.062
ERROR	22	5.917	0.269		
TOTAL	23	6.958			

LEVEL	N	MEAN	STDEV
0	12	1.9167	0.5149
1	12	1.5000	0.5222

POOLED STDEV = 0.5186



AG. ANALYSIS OF VARIANCE ON the *Number* of Strike Packages launched based on *Two* Information Levels. *TACAIR* community.

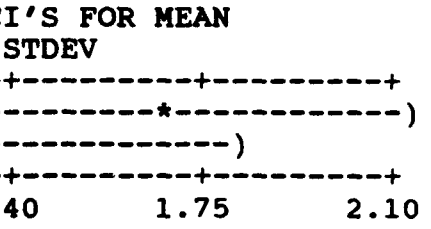
ANALYSIS OF VARIANCE ON StrkPack

SOURCE	DF	SS	MS	F	p
Level	1	0.333	0.333	1.25	0.290
ERROR	10	2.667	0.267		
TOTAL	11	3.000			

LEVEL	N	MEAN	STDEV
0	6	1.6667	0.5164
1	6	1.3333	0.5164

POOLED STDEV = 0.5164

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



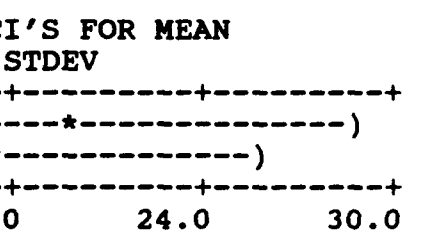
AH. ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft reaching the Target based on the *Number* of Strike Packages launched. *Two* Information Levels. *TACAIR* community.

SOURCE	DF	SS	MS	F	p
StrkPack	1	24.1	24.1	0.28	0.611
ERROR	10	874.8	87.5		
TOTAL	11	898.9			

LEVEL	N	MEAN	STDEV
1	6	20.000	9.445
2	6	17.167	9.261

POOLED STDEV = 9.353

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



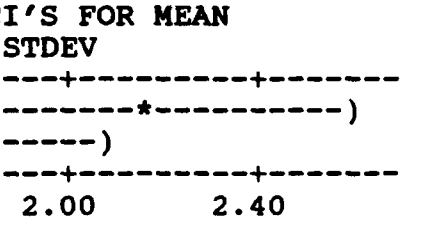
AI. ANALYSIS OF VARIANCE ON the *Number* of Strike Packages launched based on *Two* Information Levels. *NON TACAIR* community.

SOURCE	DF	SS	MS	F	p
Level	1	0.750	0.750	3.46	0.092
ERROR	10	2.167	0.217		
TOTAL	11	2.917			

LEVEL	N	MEAN	STDEV
0	6	2.1667	0.4082
1	6	1.6667	0.5164

POOLED STDEV = 0.4655

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



AJ. ANALYSIS OF VARIANCE ON the *Number* of Strike Aircraft reaching the Target based on the *Number* of Strike Packages launched. *Two* Information Levels. *NON TACAIR* community.

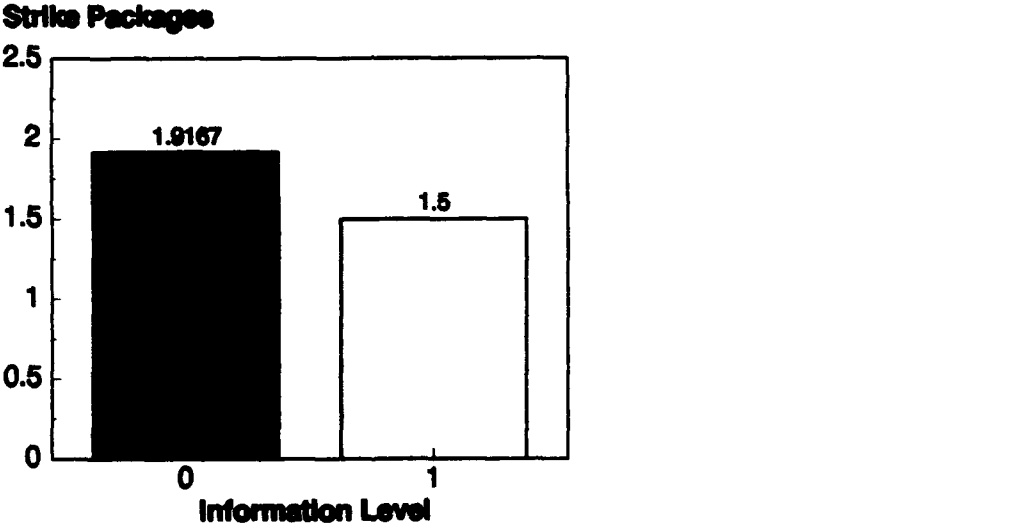
ANALYSIS OF VARIANCE ON Stk TGT

SOURCE	DF	SS	MS	F	p
StrkPack	2	122.9	61.5	1.58	0.259
ERROR	9	350.7	39.0		
TOTAL	11	473.7			

LEVEL	N	MEAN	STDEV
1	2	24.500	4.950
2	9	17.444	6.386
3	1	12.000	0.000

POOLED STDEV = 6.243

INDIVIDUAL 95% CI'S FOR MEAN
BASED ON POOLED STDEV



AK. *NUMBER* OF Strike Packages launched based on *Two* Information Levels: Both communities.

Figure 9

AL. ***MEAN NUMBER*** OF Strike Packages launched and ***MEAN NUMBER*** of Strike Aircraft reaching the Target: ***Both*** communities.

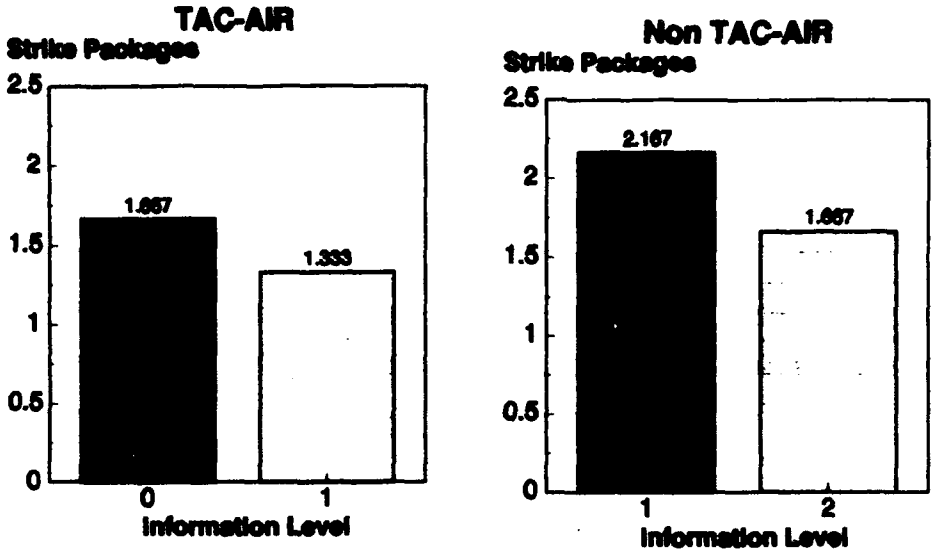


Figure 10

AM. ANALYSIS OF VARIANCE ON the ***Percent*** of Strike Aircraft reaching the Target based on the ***Number*** of Strike Packages launched; ***Both*** communities.

SOURCE	DF	SS	MS	F	p
StrkPack	2	0.3285	0.1642	5.89	0.009
ERROR	21	0.5856	0.0279		
TOTAL	23	0.9141			

LEVEL	N	MEAN	STDEV
1	8	0.9531	0.0875
2	15	0.7727	0.1949
3	1	0.4286	0.0000

POOLED STDEV = 0.1670

INDIVIDUAL 95% CI'S FOR MEAN
BASED ON POOLED STDEV

```
--------+---------+---------+--------
                              (---*---)
                         (--*--)
 (----------*-----------)
--------+---------+---------+--------
      0.30      0.60      0.90
```

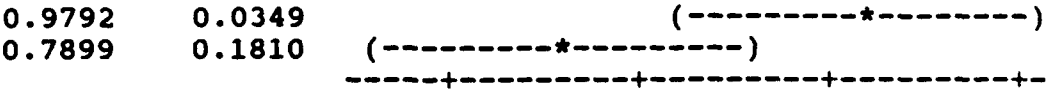
AN. ANALYSIS OF VARIANCE ON the *Percent* of Strike Aircraft reaching the Target based on the *Number* of Strike Packages launched; *TACAIR* community.

SOURCE	DF	SS	MS	F	p
StrkPack	1	0.1074	0.1074	6.33	0.031
ERROR	10	0.1698	0.0170		
TOTAL	11	0.2772			

LEVEL	N	MEAN	STDEV
1	6	0.9792	0.0349
2	6	0.7899	0.1810

POOLED STDEV = 0.1303

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



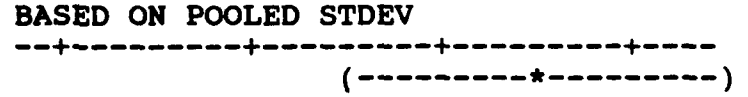
AO. ANALYSIS OF VARIANCE ON the *Percent* of Strike Aircraft reaching the Target based on the *Number* of Strike Packages launched; *NON TACAIR* community.

SOURCE	DF	SS	MS	F	p
StrkPack	2	0.1356	0.0678	1.54	0.266
ERROR	9	0.3966	0.0441		
TOTAL	11	0.5322			

LEVEL	N	MEAN	STDEV
1	2	0.8750	0.1768
2	9	0.7612	0.2137
3	1	0.4286	0.0000

POOLED STDEV = 0.2099

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



AP. *Percent* of Strike Aircraft reaching the Target based on the *Number* of Strike Packages launched: *Both* communities.

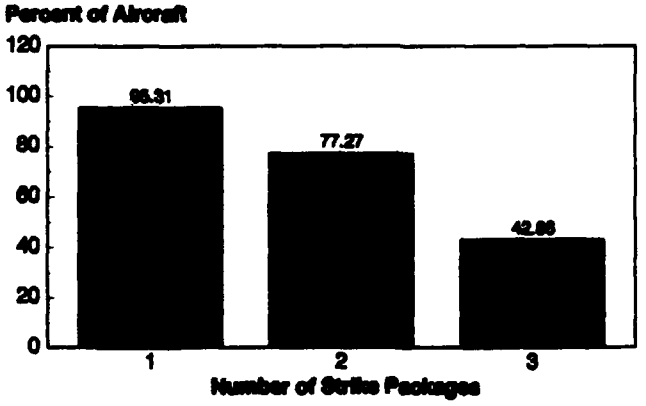


Figure 11

AQ. MEAN ***PERCENT*** of Strike Aircraft reaching the Target based on the ***Number*** of Strike Packages launched: ***Both*** communities.

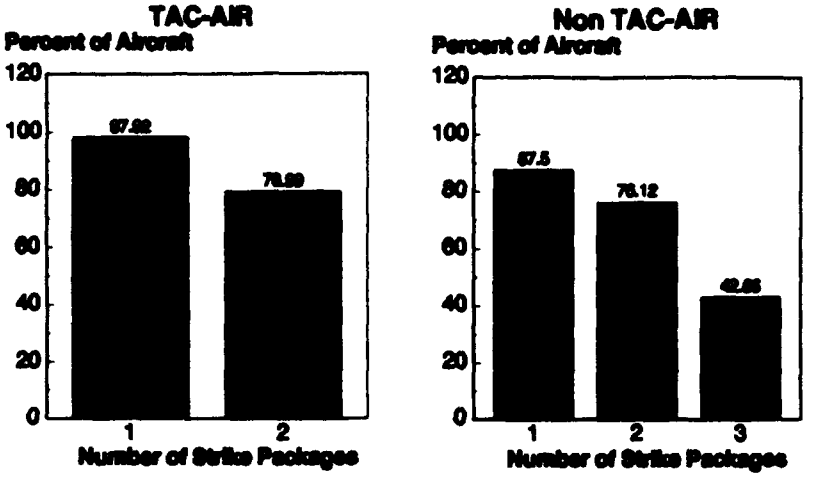


Figure 12

AR. ANALYSIS OF VARIANCE ON the ***Number*** of Badger Aircraft lost prior to reaching their Weapon Release Point based on Warfare Specialty; ***Both*** Communities.

SOURCE	DF	SS	MS	F	p
War Spec	1	0.04	0.04	0.01	0.943
ERROR	22	176.92	8.04		
TOTAL	23	176.96			

LEVEL	N	MEAN	STDEV
0	12	5.750	2.527
1	12	5.667	3.114

POOLED STDEV = 2.836

INDIVIDUAL 95% CI'S FOR MEAN
BASED ON POOLED STDEV

```
-+---------+---------+---------+-----
  (---------------*---------------)
 (---------------*---------------)
-+---------+---------+---------+-----
4.0       5.0       6.0       7.0
```

AS. ANALYSIS OF VARIANCE ON the *Number* of Badger Aircraft lost prior to reaching their Weapon Release Point based on *Four* Information Levels; *Both* Communities.

SOURCE	DF	SS	MS	F	p
Level	3	3.12	1.04	0.12	0.947
ERROR	20	173.83	8.69		
TOTAL	23	176.96			

LEVEL	N	MEAN	STDEV	INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV
0	6	5.833	2.639	(----------*----------)
1	6	5.667	2.066	(----------*----------)
2	6	6.167	4.708	(----------*----------)
3	6	5.167	1.169	(----------*----------)
POOLED STDEV =		2.948		4.0 6.0 8.0

AT. ANALYSIS OF VARIANCE ON the *Number* of Badger Aircraft lost prior to reaching their Weapon Release Point based on *Four* Information Levels; *TACAIR* Community.

SOURCE	DF	SS	MS	F	p
Level	3	8.92	2.97	0.39	0.765
ERROR	8	61.33	7.67		
TOTAL	11	70.25			

LEVEL	N	MEAN	STDEV	INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV
0	3	6.000	1.000	(----------*----------)
1	3	7.000	2.000	(----------*----------)
2	3	5.333	5.033	(----------*----------)
3	3	4.667	0.577	(----------*----------)
POOLED STDEV =		2.769		3.0 6.0 9.0

AU. ANALYSIS OF VARIANCE ON the *Number* of Badger Aircraft lost prior to reaching their Weapon Release Point based on *Four* Information Levels; *NON TACAIR* Community.

SOURCE	DF	SS	MS	F	p
Level	3	10.7	3.6	0.30	0.827
ERROR	8	96.0	12.0		
TOTAL	11	106.7			

LEVEL	N	MEAN	STDEV	INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV
0	3	5.667	4.041	(----------*----------)
1	3	4.333	1.155	(----------*----------)
2	3	7.000	5.292	(----------*----------)
3	3	5.667	1.528	(----------*----------)
POOLED STDEV =		3.464		0.0 3.5 7.0 10.5

AV. MEAN DIFFERENTIAL ANALYSIS OF the *Number* of Badger Aircraft lost before reaching their Weapon Release Point.

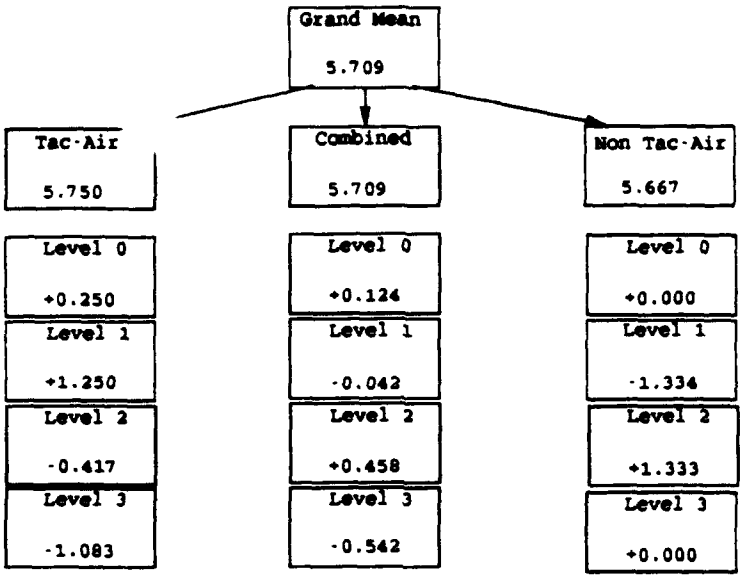


Figure 13

AW. ANALYSIS OF VARIANCE on the *Number* of Badger Aircraft lost prior to reaching their Weapon Release Point based on *Two* Information Levels; *Both* communities.

SOURCE	DF	SS	MS	F	p
War Spec	1	0.04	0.04	0.01	0.943
ERROR	22	176.92	8.04		
TOTAL	23	176.96			

LEVEL	N	MEAN	STDEV
0	12	5.750	2.527
1	12	5.667	3.114

POOLED STDEV = 2.836

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV

```
-+---------+---------+---------+-----
  (---------------*---------------)
 (---------------*---------------)
-+---------+---------+---------+-----
4.0       5.0       6.0       7.0
```

AX. ANALYSIS OF VARIANCE on the *Number* of Badger Aircraft lost prior to reaching their Weapon Release Point based on *Two* Information Levels; *TACAIR* community.

ANALYSIS OF VARIANCE ON BAD Lost

SOURCE	DF	SS	MS	F	p
Level	1	6.75	6.75	1.06	0.327
ERROR	10	63.50	6.35		
TOTAL	11	70.25			

LEVEL	N	MEAN	STDEV
0	6	6.500	1.517
1	6	5.000	3.225

POOLED STDEV = 2.520

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV

```
------+---------+---------+---------
        (----------*----------)
 (----------*----------)
------+---------+---------+---------
     4.0       6.0       8.0
```

AY. ANALYSIS OF VARIANCE on the *Number* of Badger Aircraft lost prior to reaching their Weapon Release Point based on *Two* Information Levels; *NON TACAIR* community.

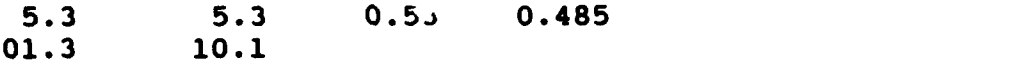
ANALYSIS OF VARIANCE ON BAD Lost

SOURCE	DF	SS	MS	F	p
Level	1	5.3	5.3	0.53	0.485
ERROR	10	101.3	10.1		
TOTAL	11	106.7			

LEVEL	N	MEAN	STDEV
0	6	5.000	2.757
1	6	6.333	3.559

POOLED STDEV = 3.183

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



AZ. MEAN DIFFERENTIAL ANALYSIS OF the *Number* of Badger Aircraft lost before reaching their Weapon Release Point. *Both* communities.

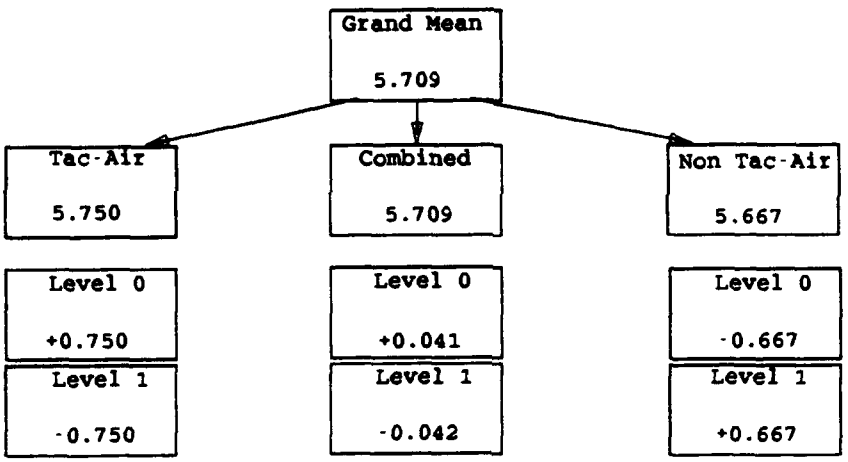


Figure 14

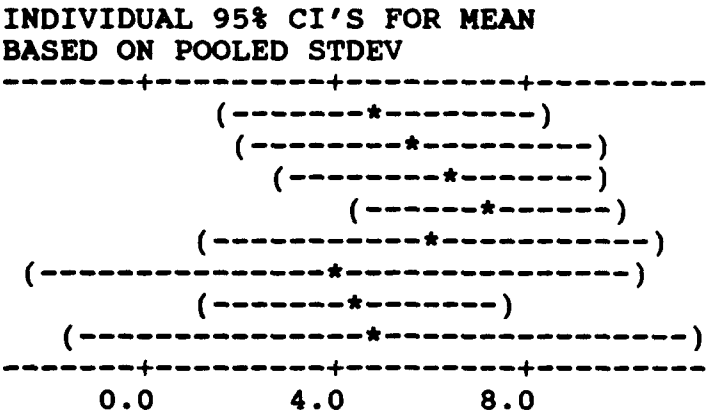
BA. ANALYSIS OF VARIANCE ON the *Number* of Badger Aircraft lost prior to Weapon Release Point based on the *Number* of CAP Aircraft launched; *Both* communities.

SOURCE	DF	SS	MS	F	p
CAP Lnch	7	23.74	3.39	0.35	0.916
ERROR	16	153.22	9.58		
TOTAL	23	176.96			

LEVEL	N	MEAN	STDEV
8	4	5.000	4.082
10	3	5.667	4.041
12	4	6.250	2.217
14	5	7.200	2.280
16	2	6.000	0.000
17	1	4.000	0.000
20	4	4.500	3.416
24	1	5.000	0.000

POOLED STDEV = 3.095

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



BB. ANALYSIS OF VARIANCE ON the *Number* of CAP Aircraft launched based on Warfare Specialty; *Both* communities.

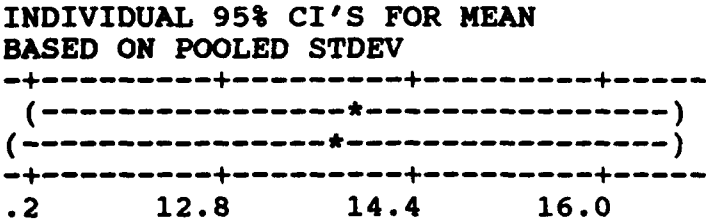
ANALYSIS OF VARIANCE ON CAP Lnch

SOURCE	DF	SS	MS	F	p
War Spec	1	0.0	0.0	0.00	0.965
ERROR	22	468.6	21.3		
TOTAL	23	468.6			

LEVEL	N	MEAN	STDEV
0	12	13.917	4.833
1	12	13.833	4.387

POOLED STDEV = 4.615

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



BC. ANALYSIS OF VARIANCE ON the *Number* of CAP Aircraft launched based on *Four* Information Levels; *Both* communities.

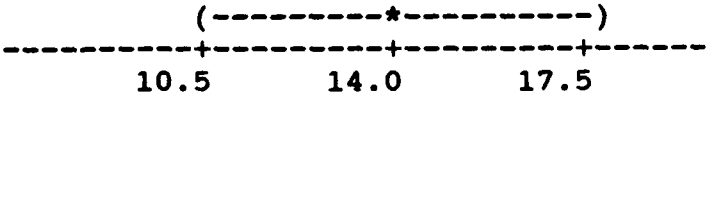
ANALYSIS OF VARIANCE ON CAP Lnch

SOURCE	DF	SS	MS	F	p
Level	3	78.5	26.2	1.34	0.289
ERROR	20	390.2	19.5		
TOTAL	23	468.6			

LEVEL	N	MEAN	STDEV
0	6	11.000	3.286
1	6	16.000	4.899
2	6	14.333	4.967
3	6	14.167	4.309

POOLED STDEV = 4.417

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



BD. ANALYSIS OF VARIANCE ON the *Number* of CAP Aircraft launched based on *Four* Information Levels; *TACAIR* community.

SOURCE	DF	SS	MS	F	p
Level	3	58.9	19.6	0.79	0.531
ERROR	8	198.0	24.7		
TOTAL	11	256.9			

LEVEL	N	MEAN	STDEV
0	3	13.333	3.055
1	3	16.667	6.429
2	3	10.667	3.055
3	3	15.000	6.245

POOLED STDEV = 4.975

INDIVIDUAL 95% CI'S FOR MEAN
BASED ON POOLED STDEV

```
----+---------+---------+---------+--
    (----------*----------)
              (----------*----------)
 (----------*----------)
          (----------*----------)
----+---------+---------+---------+--
  6.0       12.0      18.0      24.0
```

BE. ANALYSIS OF VARIANCE ON the *Number* of CAP Aircraft launched based on *Four* Information Levels; *NON TACAIR* community.

ANALYSIS OF VARIANCE ON CAP Lnch

SOURCE	DF	SS	MS	F	p
Level	3	139.67	46.56	5.17	0.028
ERROR	8	72.00	9.00		
TOTAL	11	211.67			

LEVEL	N	MEAN	STDEV
0	3	8.667	1.155
1	3	15.333	4.163
2	3	18.000	3.464
3	3	13.333	2.309

POOLED STDEV = 3.000

INDIVIDUAL 95% CI'S FOR MEAN
BASED ON POOLED STDEV

```
-+---------+---------+---------+-----
(-------*-------)
                (-------*-------)
                        (-------*-------)
          (-------*-------)
-+---------+---------+---------+-----
5.0       10.0      15.0      20.0
```

BF. *Number* of Badger Aircraft destroyed before reaching Weapon Release Point based on the *Number* of CAP Aircraft launched: *Both* communities.

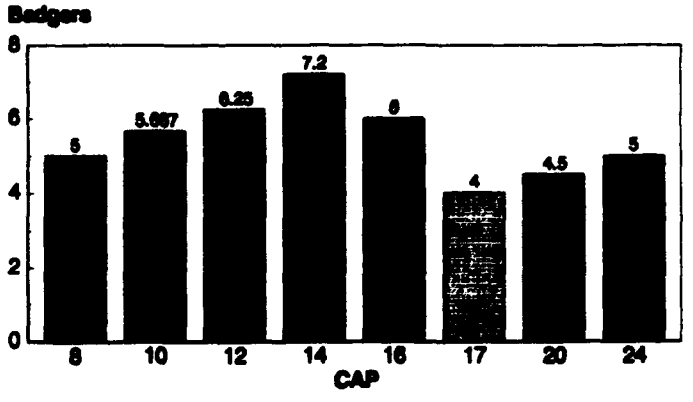


Figure 15

BG. MEAN DIFFERENTIAL ANALYSIS OF the *Number* of CAP Aircraft launched based on *Four* Information Levels: *Both* communities.

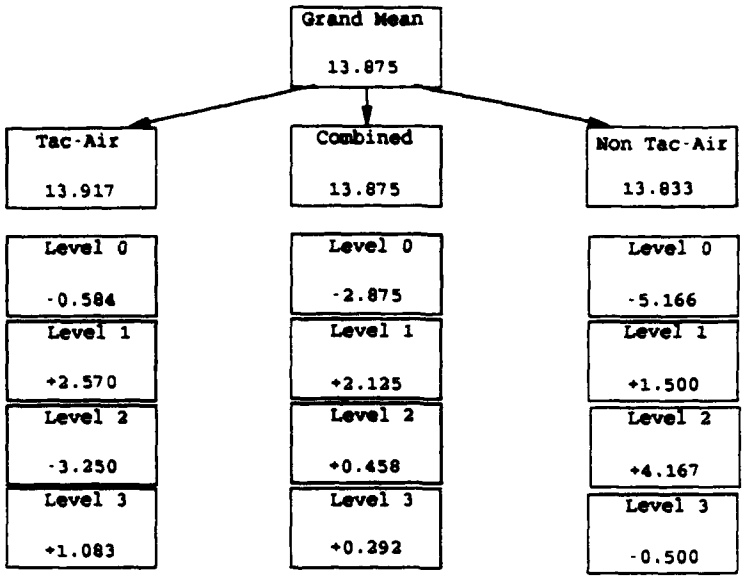


Figure 15

BH. ANALYSIS OF VARIANCE on the *Number* of CAP Aircraft launched based on *Two* Information Levels. *Both* Communities.

ANALYSIS OF VARIANCE ON CAP Lnch

SOURCE	DF	SS	MS	F	p
Level	1	3.4	3.4	0.16	0.693
ERROR	22	465.3	21.1		
TOTAL	23	468.6			

LEVEL	N	MEAN	STDEV
0	12	13.500	4.758
1	12	14.250	4.434

POOLED STDEV = 4.599

INDIVIDUAL 95% CI'S FOR MEAN
BASED ON POOLED STDEV

```
------+---------+---------+---------
 (-----------*-----------)
    (-----------*-----------)
------+---------+---------+---------
     12.0      14.0      16.0
```

BI. ANALYSIS OF VARIANCE ON the *Number* of CAP Aircraft launched based on *Two* Information Levels. *TACAIR* Community.

SOURCE	DF	SS	MS	F	p
Level	1	14.1	14.1	0.58	0.464
ERROR	10	242.8	24.3		
TOTAL	11	256.9			

LEVEL	N	MEAN	STDEV
0	6	15.000	4.858
1	6	12.833	4.997

POOLED STDEV = 4.928

INDIVIDUAL 95% CI'S FOR MEAN
BASED ON POOLED STDEV

```
------+---------+---------+---------
        (-----------*-----------)
 (-----------*-----------)
------+---------+---------+---------
     10.5      14.0      17.5
```

BJ. ANALYSIS OF VARIANCE ON the *Number* of CAP Aircraft launched based on *Two* Information Levels. *NON TACAIR* Community.

SOURCE	DF	SS	MS	F	p
Level	1	40.3	40.3	2.35	0.156
ERROR	10	171.3	17.1		
TOTAL	11	211.7			

LEVEL	N	MEAN	STDEV
0	6	12.000	4.561
1	6	15.667	3.670

POOLED STDEV = 4.139

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV

```
-------+---------+---------+---------
 (---------*----------)
           (----------*----------)
-------+---------+---------+---------
      10.5      14.0      17.5
```

BK. MEAN DIFFERENTIAL ANALYSIS ON the *Number* of CAP Aircraft launched based on *Two* Information Levels: *Both* communities.

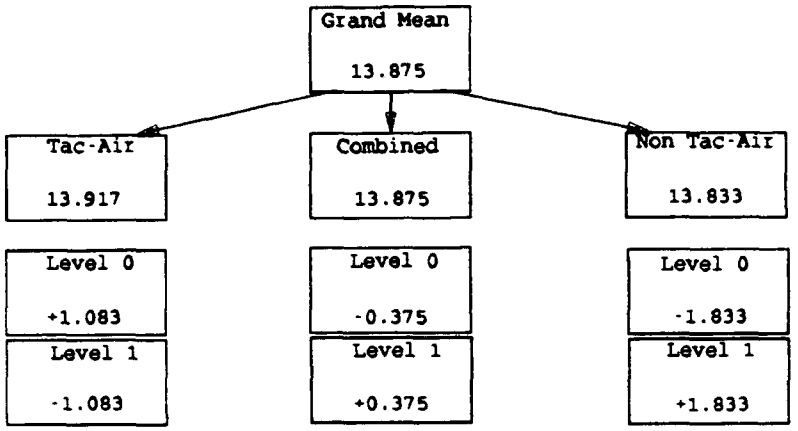


Figure 17

BL. ANALYSIS OF VARIANCE ON the *Number* of unidentified air and surface contacts identified based on Warfare Specialty; *Both* communities.

SOURCE	DF	SS	MS	F	p
War Spec	1	0.00	0.00	0.00	1.000
ERROR	22	98.50	4.48		
TOTAL	23	98.50			

LEVEL	N	MEAN	STDEV
0	12	8.750	2.491
1	12	8.750	1.658

POOLED STDEV = 2.116

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV

```
----+---------+---------+---------+--
 (----------------*----------------)
 (----------------*----------------)
----+---------+---------+---------+--
  7.70      8.40      9.10      9.80
```

BM. ANALYSIS OF VARIANCE ON the Number of unidentified air and surface contacts identified based on Four Information Levels; Both communities.

SOURCE	DF	SS	MS	F	p
Level	3	19.50	6.50	1.65	0.211
ERROR	20	79.00	3.95		
TOTAL	23	98.50			

LEVEL	N	MEAN	STDEV
0	6	8.667	3.011
1	6	10.167	1.169
2	6	7.667	2.066
3	6	8.500	1.049

POOLED STDEV = 1.987

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV

```
---+---------+---------+---------+---
       (---------*---------)
                 (---------*---------)
(---------*---------)
      (---------*---------)
---+---------+---------+---------+---
 6.4       8.0       9.6      11.2
```

BN. ANALYSIS OF VARIANCE ON the Number of unidentified air and surface contacts identified based on Two Information Levels; Both communities.

ANALYSIS OF VARIANCE ON Ctc ID based on two Information Levels

SOURCE	DF	SS	MS	F	p
Level	1	10.67	10.67	2.67	0.116
ERROR	22	87.83	3.99		
TOTAL	23	98.50			

LEVEL	N	MEAN	STDEV
0	12	9.417	2.314
1	12	8.083	1.621

POOLED STDEV = 1.998

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV

```
---+---------+---------+---------+---
             (--------*---------)
(---------*---------)
---+---------+---------+---------+---
 7.2       8.4       9.6      10.8
```

BO. MEAN DIFFERENTIAL ANALYSIS OF the Number of unknown contacts identified: Four and Two Information Levels: Both communities.

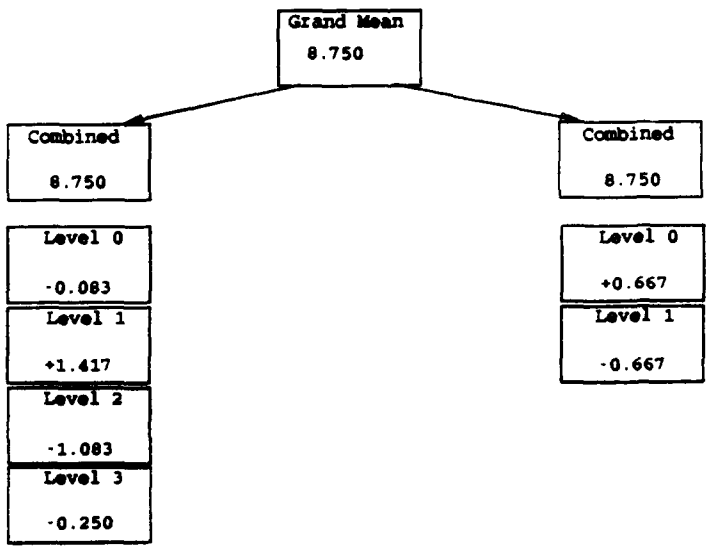


Figure 18

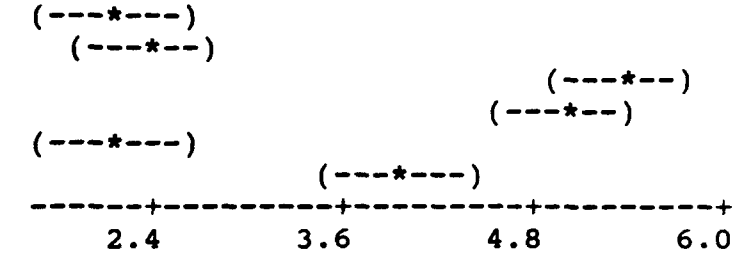
BP. ANALYSIS OF VARIANCE ON player Information Brief relevance. *Both* communities.

SOURCE	DF	SS	MS	F	p
FACTOR	5	238.00	47.60	40.80	0.000
ERROR	126	147.00	1.17		
TOTAL	131	385.00			

LEVEL	N	MEAN	STDEV
Aircraft	22	2.182	0.958
SAM	22	2.364	1.255
Logistic	22	5.364	0.658
OP Comm	22	5.000	0.756
Air Surv	22	2.136	1.037
DefStrat	22	3.955	1.558

POOLED STDEV = 1.080

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



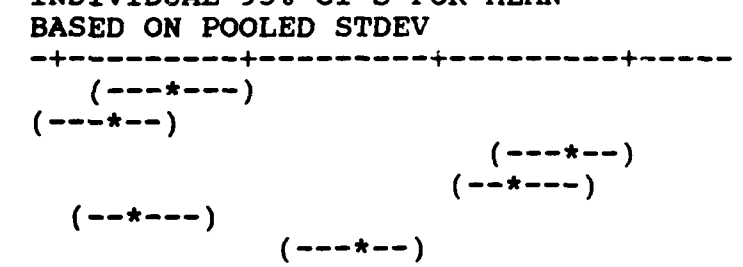
BQ. ANALYSIS OF VARIANCE ON player Information Brief relevance. *TACAIR* community.

SOURCE	DF	SS	MS	F	p
FACTOR	5	148.167	29.633	31.63	0.000
ERROR	66	61.833	0.937		
TOTAL	71	210.000			

LEVEL	N	MEAN	STDEV
TA a/c	12	2.4167	0.7930
TA SAM	12	1.9167	0.9962
TA LOG	12	5.5000	0.7977
TA COMM	12	5.1667	0.5774
TA SURF	12	2.1667	1.1146
TA STRAT	12	3.8333	1.3371

POOLED STDEV = 0.9679

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



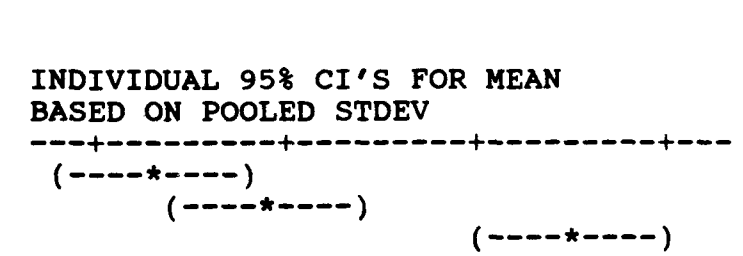
BR. ANALYSIS OF VARIANCE ON player Information Brief relevance. *NON TAC AIR* community.

SOURCE	DF	SS	MS	F	p
FACTOR	5	98.20	19.64	13.81	0.000
ERROR	54	76.80	1.42		
TOTAL	59	175.00			

LEVEL	N	MEAN	STDEV
NTA a/c	10	1.900	1.101
NTA SAM	10	2.900	1.370
NTA LOG	10	5.200	0.422
NTA COMM	10	4.800	0.919
NTA SURV	10	2.100	0.994
NTA STRA	10	4.100	1.853

POOLED STDEV = 1.193

INDIVIDUAL 95% CI'S FOR MEAN BASED ON POOLED STDEV



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